THURSDAY, JULY 25, 1895.

THE DISTRIBUTION OF ANIMALS.

A Text-Book of Zoogeography. By F. E. Beddard, M.A., F.R.S. Cambridge Natural Science Manuals. Pp. viii. and 246. (Cambridge: University Press, 1895.)

WITHIN the small limits of 246 duodecimo pages of fairly large type, it is scarcely possible to do justice to such an extensive subject as the geographical distribution of animals; and, bearing in mind the difficulties thus imposed upon him, we think the author of the volume before us is, on the whole, to be congratulated on the manner in which he has completed a very difficult task. He has given the student a large amount of very valuable information, and this in a pleasantly-written and easily-understood form. A writer who was not thoroughly at home in his subject might have contented himself with merely giving us abstracts of Mr. Wallace's works, with such corrections as are necessary in order to bring them up to date. Not so Mr. Beddard, who has introduced into his text-book a very large number of facts, chiefly relating to the lower vertebrates and invertebrates, which are not to be found in more pretentious works, and his volume will thus be of value to all students. As being one of the author's specialities, attention is strongly directed to the distribution of earth-worms; and the remarks concerning the curious relationship between the worms of Patagonia and those of Australia and New Zealand will be found specially interesting.

The general plan of the work is as follows. After defining locality and station, and pointing out the variability in the distributional areas of animals, the author takes a number of selected instances, drawn from very varied classes, of the distribution of particular groups. We have, for example, the range contrasted of such different animals as rheas, ibexes, gallinaceous birds, edentates, tortoises, batrachians, scorpions, planarians, and earth-worms. Having contrasted the differences presented by these groups, Mr. Beddard comes to the consideration of zoological regions; and here he concludes on the whole to adopt those of Messrs. Sclater and Wallace. "As a mere matter of convenience," he remarks, "it is immaterial whether we join Europe, Asia, and North America into one Holarctic region, or use the current terms of Nearctic and Palæarctic for the Old and New World divisions of this extensive tract." With all due deference, we submit that convenience has nothing whatever to do with the matter; and it is to be regretted that the author has not been bolder, and made a clean sweep of what is obsolete in our present system of zoological geography. He admits that mammals are, on the whole, the most satisfactory group on which to lay the foundations of the scheme; and yet he deliberately throws away Mr. Blanford's very excellent classification, in order to adopt one which obviously does not accord with the facts.

A want of boldness is, indeed, in our opinion, one of the most serious defects in the work, and we should have much liked to hear the author express, without reservation, his real opinions both as regards the so-called Antarctica, and also in respect to Dr. Baur's view that the Galapagos Islands are part of a sunken continent. We gather that, on the whole, Mr. Beddard appears to be indisposed to admit Antarctica in its entirety, but as to how much he believes in a southern land connection of more limited extent, it is almost impossible to discover. In this section of the work, moreover, the author has made two glaringly contradictory statements. Thus whereas on page 116, in treating of the limits of the Australian region, he remarks that "the boundary between it and the Oriental is sharply marked," we find him on page 106 hesitating whether Celebes should not be transferred from the former to the latter region. So much for sharp boundaries.

The third chapter deals with the causes influencing distribution; and here it may be noted that the author differs from Dr. C. H. Merriam,[1] in that he attributes a very minor part to the influence of temperature. Not improbably, however, the difference of opinion is largely due to the different environment of the two workers, the effects of this factor being apparently more noticeable in the New World than in the Old. Very many interesting instances bearing on the problem of dispersal will be found in this chapter. In the fourth chapter, the faunas of islands are discussed; while the fifth closes the work with a few theoretical considerations. In this chapter we find the remarkable suggestion that Marsupials have taken their origin in Australia; a conclusion which, in our opinion, has no shadow of justification from the facts of their past history, and which is absolutely contradicted by the author himself. After stating on page 226, that their "number in Europe may have been small," he speaks of these animals on page 227 as "once existing in great variety in Europe and North America," and later on in the same page that the "survivors have been pushed in to the furthest corner of the world—the Australian continent, and some of the islands to the north." More hopelessly contradictory statements it would be difficult to find. As to the author's conclusions that there has been a general migration of the older forms from north to south, we are in full accord.

It is much to be regretted, especially from the point of view of elementary students, that the work should be disfigured by several glaring inaccuracies which ought to have been corrected in proof. We find, for instance, the genus *Anurosorex* given as exclusively Palæarctic, whereas one of the two known species is from Assam. On the same page, again, the genus *Capra* is likewise given as confined to the Palæarctic region, whereas, on p. 22, the South Indian *C. hylocrius* is included in the same genus. Should Mr. O. Thomas ever read the work, he will be surprised to learn (p. 90) that he has identified the African pouched rats of the genus *Cricetomys* with the American *Hesperomys*. On p. 97 we have "musk-deer" in place of "musk-ox"; while on p. 100 we find the Siberian hippopotamus figuring as *Chœropotamus* (the name of an Eocene genus of pigs) instead of *Chœropsis*. Again, on p. 103, we have the langurs alluded to under the name of *Presbytes*, while on p. 106 they appear as *Semnopithecus*. By what confusion of ideas the name *Hyracodon* (which belongs to an extinct genus of rhinoceros-like animals) is made to do duty for *Didelphys*, we are at a loss to understand. Carelessness is likewise

[1] See *Nat. Geogr. Mag.*, vol. vi. pp. 229-238 (1894).

exhibited by the statement, on p. 111, that *Rhea* is exclusively confined to the Chilian sub-region of South America, especially after the author has stated on p. 20 that *Rhea macrorhyncha* occurs in Pernambuco and Bahia.

As likely to mislead the student, we must also call attention to the so-called genera *Aquias* and *Phyllotis* being placed among those characteristic of the Oriental region, whereas Dr. Dobson,[1] whose views are endorsed by Mr. Blanford, states that there is no justification for the separation of the forms thus named from the ordinary *Rhinolophus*. If the author has reason to doubt the correctness of such generally accepted views, he should have appended a note to that effect. Many other points of this nature might be alluded to; but we cannot help regretting that the author has once more resuscitated the myth of the fossil Australian elephant.

While the book would have been much better had more care been exercised on its composition and correction, it will serve a useful purpose as a general guide to the principles of the geographical distribution of animals, and may accordingly be recommended to the student, provided he have sufficient knowledge to steer clear of the pitfalls.

R. LYDEKKER.

ALKALI MANUFACTURE.

A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali, with the Collateral Branches. By George Lunge, Ph.D., Professor of Technical Chemistry at the Federal Polytechnic School, Zurich. Second edition, vol. ii. Pp. xi. 929. (London: Gurney and Jackson, 1895.)

TO criticise, in the ordinary sense of the term, such a book as this, demands an experience as wide as that of the author—not only in the laboratory investigation and the exposition of the problems of chemical technology, but in the exigencies of daily life in a chemical works. This dual experience is possessed by few, and the present writer can lay no claim to it. But the wide acceptance of the first edition of Dr. Lunge's book as *the* work of reference on alkali manufacture, makes the expression of a judgment on its value superfluous, and the reviewer need do little more than make a general comparison between the present volume and its predecessor of fifteen years ago.

It may at once be said that the book has been thoroughly brought up to date. It is bulkier than the former edition to the extent of over 200 pages, though many processes described in detail in the earlier work, being now obsolete, or nearly so, are here merely referred to; but though some of this increased bulk arises from lengthy detailed accounts of new processes, yet most of it is due to the small additions interpolated on almost every page of the book. No published work on alkali manufacture appears to have escaped Dr. Lunge, whether in journal or patent literature; and he has not only furnished an admirable digest of the progress made in technological thought and practice since 1880, but has throughout given references to original sources.

One change in arrangement commends itself at once: the modes of occurrence and properties of raw materials and products are collected in the first chapter, while analytical methods are similarly gathered together in the second. A striking feature in the first chapter is the amount of space devoted to native soda. Recent explorations have greatly extended our knowledge of the occurrence of this substance, and with sources of supply like Owen's Lake in California, it seems not at all unlikely that in a few years native soda may compete on a large scale with that manufactured by the Leblanc and the ammonia processes. The chapter on analytical methods is very complete, the chief new feature in it being the description and illustration of Lunge and Marchlewski's gas analysis apparatus on p. 113. It seems a pity that those who buy and sell alkali should not by this time have reformed the chaotic condition of "trade customs" which makes it necessary still to devote five pages of a work like this to the question of alkalimetric "degrees."

In the chapter on the salt-cake process the changes consist chiefly in the greater prominence given to plus-pressure furnaces, of which two forms are figured, and to mechanical furnaces. At the date of the first edition, plus-pressure furnaces were in little more than an experimental stage; but the advantages they present have gradually made themselves felt, and their use has become correspondingly more frequent. The early type of the Jones mechanical furnace has been omitted from this edition, and mechanical furnaces are represented by the later form of the Jones furnace, with fixed stirrers and movable bottom, by the Mactear furnace, and by Larkin's mechanical roaster. These furnaces are all fully described and figured, and the discussion of their merits and demerits is eminently fair. The account of the Hargreaves process has been completely rewritten and greatly improved, entirely new drawings of the arrangement of the cylinders having been introduced. That this beautiful process should not have further extended, is matter for regret; but, as Dr. Lunge justly says, it came too late—it has had to succumb to the competition of the ammonia soda process, and the consequent necessary subordination of other considerations to the production, in the Leblanc process, of strong hydrochloric acid.

The condensation of hydrochloric acid had reached such a stage at the date of publication of the first edition, that we find but few changes in this one, and but two noticeable additions: an account and discussion of Dr. Hurter's mathematical treatment of condensation, and a description of the Lunge-Rohrmann plate-columns. The gist of Dr. Hurter's papers is, on the whole, very faithfully reproduced; but there are two errors which are likely to cause confusion to the reader unacquainted with the originals: on p. 308, lines 6 to 10, where the source of the figure 43·3 is not obvious, the fact being that it is quoted from a third example of Hurter's, in which the gas dealt with contains 43·3 per cent. of hydrochloric acid; and on p. 313, where, in converting Dr. Hurter's English measures into metric units, 20 cubic feet per second is taken as 20 feet per second, and the resulting contact figure is worked out to 324 instead of 3474. The Lunge towers are described in the body of the work, and details of their structure, as well as a summary of results obtained in their actual working at Duisburg, are given in the addenda. These figures are certainly remarkable testi-

[1] "Cat. Chiroptera Brit. Mus.," p. 206.

mony to the efficiency of the plate-columns ; whether in all respects they will achieve the results their inventor claims for them, it is, perhaps, yet premature to say.

The chapters on the black ash process, on the manufacture of finished soda, and on caustic, are examples of what has been said above as to Dr. Lunge's care and industry ; exhibiting no striking changes, they are yet charged with additional matter, of which no satisfactory account can be given, but which will become continually evident to those using the book.

The recovery of sulphur from tank waste is, of course, treated at length. The multitude of attempts to solve this problem, the repeated failures—chemical or economic—of these attempts, the apparent hopelessness of further discovery in so well-explored a field, and the tenacity with which the attack has been continued, form one of the most interesting chapters in the history of manufacturing chemistry, and the account given here is full and accurate. Though the detailed description of Schaffner and Helbig's process has been omitted from this edition, yet the bulk has swelled by some forty pages, an increase due, of course, chiefly to the Chance-Claus process, the account of which, with its modifications and variations, is one of the best written portions of the book. How far this beautiful process affords a satisfactory solution of the problem of sulphur-recovery, may be gleaned from the fact that in 1893 the produce of Chance sulphur in Britain was estimated at 35,000 tons.

An indication of the tendency of chemical manufacture to become more scientific, to be guided by principles rather than by rule-of-thumb, is found in the increased amount of "theory" in the book. Not only have we accounts of investigations into the reactions involved in the various processes, but also accounts of the thermochemistry of the Hargreaves process and the black ash process, and of Dr. Hurter's application of mathematics to technology, mentioned above. No one will dispute Dr. Lunge's statement that manufacturing conditions are complex, and difficult to imitate in laboratory experiments, still more to state in a form definite enough for mathematical expression : no one will question the justness of his warning against proceeding too rashly on lines suggested by theory alone, or indicated by mathematical reasonings on insufficient bases ; but the fact that thermochemistry and mathematics find a place at all in such a work as this, shows that our manufactures are being conducted with a closer knowledge than formerly of the principles—chemical, physical, and mechanical—which underlie them, and that we may look forward to a time when we shall have as full control over the conditions of our operations in the manufactory as we now have in the laboratory.

The Leblanc soda process is regarded, by those who are in any way connected with it, with feelings akin to those with which they look on the British Constitution. It inspires a certain affectionate respect, from its combined familiarity and antiquity ; and the contemplation of its decay or extinction gives rise to feelings of regret, apart altogether from the pecuniary interests which are involved in it. The statistics given by Dr. Lunge, which show a steady increase in the salt used for the ammonia process, from 27,000 tons in 1880, to 350,000 in 1895, while that used for the Leblanc process has decreased in the same period from 650,000 to 470,000, are not reassuring ; but if the older process be doomed to ultimate extinction it will at least have a worthy monument and history in the successive editions of Dr. Lunge's book.

Misprints and slips in such a work are inevitable ; there are several, but nearly all such as betray themselves at once, and carry their corrections on their faces. A copious index to the volume adds greatly to its value for reference. J. T. DUNN.

PHYSICAL ANALOGUES OF PROTOPLASMIC MOVEMENT.

Microscopic Foam and Protoplasm. By Otto Bütschli. Translated by E. A. Minchin. (London : Black, 1894.)

PROF. BÜTSCHLI'S work on Microscopic Foams has been already discussed in these columns ; and therefore, in noticing the English translation, a very short account of the book itself will suffice. From his long series of observations, especially upon the structure of the protozoa, the author was led to regard protoplasm as a substance arranged always in the manner of an exceedingly minute honeycomb, containing a second substance in its cells. Taking this view of the structure of protoplasm, and probably stimulated by the experiments upon capillarity and surface-tension made by his colleague Prof. Quincke, he next endeavoured to find a substance having an analogous physical structure, and to produce in it some of the simpler phenomena of protoplasmic movement. The result was the manufacture of the remarkable foams, now so well known in zoological laboratories, in which the walls of the protoplasmic honeycomb are represented by thin lamin:e of olive oil, the chambers containing a solution of potassium carbonate and soap. The remarkable resemblance between the histological structure exhibited by drops of this substance, and that of an amœba, is probably familiar by this time to most biologists, as is the resemblance between the streaming movements of the two structures, and the protrusion and retraction of pseudopodia by each.

In the work before us, the final investigations upon oil-foams are first described. The first eighty pages contain a minute description of the manner in which the foams are best prepared, and of their behaviour under the influence of various agencies. Especially interesting is the effect of induction shocks, by which convulsive movements are obtained, and the streaming is frequently slowed down or depressed. It is difficult to avoid comparing the manner in which such a foam-drop flows towards a solution of certain substances, such as soap, with the simpler phenomena of "chemiotaxic" attraction.

After a detailed description of the preparation and behaviour of oil-foams follows a summary of investigations on the structure of protoplasm, as seen in the living condition and after various methods of preparation. This account deals with the structure of various protozoa, and with the cells of many metazoon tissues, especially with nerve-cells and fibres ; the object of the whole account being to demonstrate the "alveolar" structure of the protoplasm in all these cases. This account is illustrated by several plates, which have been admirably re-drawn for the English edition of the work, and in addition to these a collection of photographs has been prepared

illustrating the minute structure of oil-drops, and of many of the animal cells described. The evidence of this series of photographs is perhaps even more striking than that of the plates; and it is well here to draw special attention to them, because the only information given to the English reader as to the means of obtaining them is in a note on p. 341, where it may be easily overlooked.

The second part of the book contains a short history of the views which have been held concerning the structure of protoplasm, from the time of Remak's early observations on nerve-fibres until the year 1892; this is followed by a full exposition of the view that all protoplasm has the foamy structure exhibited by the oil-foams already described, and by a discussion of the difficulties which attend the explanation of all protoplasmic movement by reference to changes in the surface tension of a foamy substance.

Such is the arrangement of a work containing the most remarkable attempt to express protoplasmic movement in terms of inorganic phenomena which has yet been made. That the attempt is not yet successful in a number of special cases, Prof. Bütschli himself is careful to point out; and the difficulty of explaining in this way the formation of fine thread-like pseudopodia is, as he admits, very great. A more serious difficulty, even in cases of simple lobose motion, is the difficulty of demonstrating those currents in the water outside an amœba in motion, which should, on the diffusion-theory, exist. These and other points are clearly stated by Prof. Bütschli, so as to inspire the hope that the final section of his book will lead to the prosecution by himself and his pupils, and by others, of further work on the lines he has here laid down. Without such investigation, any detailed criticism of the difficulties would be simply impertinent.

Mr. Minchin is to be congratulated on his translation. The original German, while always lucid, is often difficult to translate, because the author has throughout been influenced on the one hand by a desire to be as brief as possible, and on the other by a spirit of scientific caution; so that he qualifies statement after statement with epithets which make his sentences easy enough to understand, but hard to render into such English as Mr. Minchin has generally achieved.

By incorporating the appendix of the original edition in the body of the work, a distinct advantage has been gained; and a useful feature, wanting in the German edition, is a very excellent index.

OUR BOOK SHELF.

Æsthetic Principles. By Henry Rutgers Marshall, M.A. (New York and London: Macmillan, 1895.)

MR. MARSHALL has done such good work in the field of æsthetics that we are glad to welcome this short and simplified exposition of the principles which he regards as fundamental. As we said on reviewing his more technical treatise, there is good stuff in his work, and it is based on right lines. We have only space to deal very briefly with one or two points on which we are still constrained to assume a somewhat critical attitude.

Although the view that pleasure is the accompaniment of the using up of surplus stored energy, and that pain arises when the stimulus calls for an overdraught of energy, may well hold good in certain fields of activity, it does not appear to touch some of the pleasures and pains of special sense. That certain groups of sensory stimuli are pleasurable, and others painful, seems just as primary and inexplicable (and therefore to be at present treated merely descriptively) as that certain light-vibrations give rise to the sensation blue, and others to the sensation red. They are primary data of "algedonics," as the colour-sensations are primary data of colour-vision.

In the helpful classification of "Instinct-feelings," so-called, we think more stress is laid on heredity than the facts at present justify. That there is an innate inherited potentiality of fear, for example, is unquestionable; and that it is connected with a tendency to flee from a disadvantageous object, may be admitted. But the disadvantageous nature of the object would seem to be a matter of individual experience, aided by the effects of what Mr. Hudson terms tradition through parents or others. It is at least questionable whether the advantageous or disadvantageous nature of the object is "determined by the experience of untold generations of ancestry."

The third, and last, point on which we would touch is the delimitation of the æsthetic field. That what is judged to be æsthetic appears to be permanently pleasant in revival may be, and in the main is, true enough. But that the relative permanence of the pleasure-field can be regarded as a sufficient æsthetic differentia, we are not prepared to admit. We cannot here discuss the question; we hold, however, that just as the pleasures and pains of sense on the algedonic accompaniments of sense-experience, so are the distinctively æsthetic pleasures and pains the algedonic accompaniments of the perception of relations. Mr. Marshall's criticisms of the intellectualist position (if this view of the purely algedonic accompaniment of activities, which in their cognitive aspect are intellectual, may be included under this head) is insufficient to carry conviction.

We have selected one or two points on which Mr. Marshall's views do not appear to us to be convincing; but it is partly because he is really worth differing from, that we can recommend his work for careful and serious consideration.

An Analysis of Astronomical Motion. By Henry Pratt, M.D. (London: G. Norman and Son, 1895.)

THE present small volume is a contribution to the ever-increasing mass of pseudo-scientific literature, in dealing with which a scientific reviewer must always find a difficulty. His first impulse is to ignore such a book altogether, but there are objections to such a course. To preserve strict silence might, in the first place, lead the author, and those who blindly trust his guidance to claim that his work was of real scientific value, since it had been tacitly accepted by the scientific world, or, at least, that his theory could not be confronted by any fatal *à priori* objections. Further, a book of this kind is liable to lead astray the untrained minds of chance readers, and one's duty to the public requires that some effort should be made to prevent the waste of time and money over an ignorant and worthless book.

Dr. Pratt's object in publishing the book is to give a simpler expression to the views developed in his earlier work, "Principia Nova Astronomica" (see NATURE, May 17, 1894). He may have found that students needed additional explanations, or that another advertisement was necessary to assist the sale of the earlier work. If the course were prompted by the first suggestion, one cannot say that the author has been altogether successful, for his theory remains quite as obscure and unsatisfactory as when first presented. The distinguishing feature of this theory requires our own sun to revolve round an "equatorial" sun, which in turn revolves round a "polar"

sun, which finally has its centre of motion in a "central" sun. "The evidence of the existence of the central, polar, and equatorial suns is found in certain observed phenomena, hitherto attributed to other causes, but which are in reality due to their presence and influence." Besides the simple enumeration of these phenomena, it is in vain to look for any direct proof of this statement. The author's method of removing objections to his theory, one of the principal objects of this book, is, however complicated in detail, extremely simple in principle. It practically consists in calling a motion, or an absence of motion, when it does not fit in and support his theory, *apparent*, and when such motion can be explained, or Dr. Pratt considers is explained, *real*. Such juggling with phenomena resulting from a combination of revolution and rotation, naturally presents no difficulty to a man who cannot see that a body revolving in an orbit, and always presenting the same face to the centre of the orbit, rotates once in the period of revolution. But others, taught in a different and more rigorous school, have great difficulty in apprehending the author's meaning, and fail altogether to appreciate the arguments by which he seeks to support the successive parts of his theoretical system.

Neither does Dr. Pratt understand the arguments, nor, as far as we can see, admit the facts, by which the gravitational theory is supported. In the third chapter, the author, in criticising our current ideas of planetary motion, discloses the awkward fact, that he has not the slightest acquaintance with Kepler's laws. He has not taken the trouble to master the first principles of the system he would overthrow, but seems to think himself qualified by inspiration to offer another. His inspiration, we fear, is due to a disordered and ill-regulated imagination.

LETTERS TO THE EDITOR.

The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*]

The Physical Properties of Argon.

THE following measurements may be of interest in connection with the chemical position of argon. The gas was prepared from atmospheric air with the aid of oxygen and alkali only.

Weighings at 0° C. upon a large scale (two litres), and with the apparatus formerly employed for other gases, give as the density of argon ($O_2 = 16$)

19·940,

a number in almost exact agreement with that obtained by Prof. Ramsay, working upon a relatively small scale and with gas derived by magnesium (Rayleigh and Ramsay, *Phil. Trans.*, 1895).

In spite of its greater density, the refraction ($\mu - 1$) of argon is only ·961 of that of air; so that if we take for air under standard conditions $\mu = 1{\cdot}0002923$, then for argon

$$\mu = 1{\cdot}000281.$$

Terling Place, July 20. RAYLEIGH.

The Teaching University for London.

I WAS absent from the country during the University of London Election; but I may be permitted to make a few remarks on Sir John Lubbock's letter in the last number of NATURE.

I am afraid he has hardly weighed the very serious consequences of the action he has taken. They will have to be met as best we may. What I now desire to consider is some of the grounds on which he has attempted to defend it. These themselves afford matter for sufficiently grave reflection.

(i.) Sir John states in his letter to Prof. Rücker: "I am not asking that any privilege which they do not at present possess should be conferred on my constituents, but only supporting what is now their legal right. . . . This right I know they highly value." This is a most extraordinary statement. What Convocation undoubtedly possesses is the right of veto on any fundamental change in the constitution of the University. It has been exercised in the past to some effect when Convocation summarily rejected the recommendations of the first of the recent Commissions. It might have been exercised when Convocation assented to the admission of women to the University. But it has never hitherto been exercised except by the personal vote of members attending Convocation who have had the opportunity of hearing in adequate debate the arguments for and against the proposal at issue. What Sir John proposes now is something widely different: a *referendum*, in fact, in which the decision of Convocation is to be signified "as at a Senatorial election," *i.e.* by voting papers. In my judgment such a precedent, if once established, would utterly destroy the prestige and authority of the meetings of Convocation as at present constituted. To this point I will return presently. But at any rate I think it will be admitted by all who know anything of the practical working of this body that Sir John's proposal is a pretty revolutionary change. How then are we to reconcile it with his language which I have quoted above.

(ii.) But Sir John's action becomes still more extraordinary in the light of the actual recent proceedings of Convocation itself. To read his letter it might be thought that we were smarting under a sense of injury and injustice, and that Sir John, as in duty bound, had come chivalrously to the rescue of our oppressed body. Far from this being the fact, I think, that in plain language Sir John has given Convocation the severest slap in the face it has ever received.

After the report of the first Commission was dead and buried, the second came up in due course for consideration by Convocation, and for the past two years its mind has been occupied with little else. The report might have succumbed to the veto like its predecessor, but it did not. I need not recapitulate all that has happened. It is enough to say that though Convocation approached the conclusions of the Commission with a certain timidity or, at any rate, reserve, their substantial acceptance after each successive debate steadily gained ground.

Finally at the meeting on January 22 of the present year the following resolution was carried:—

"That Convocation, while desiring to express generally its approval of the proposals contained in the Report of the Royal Commission, is of opinion that power ought to be given to the Statutory Commission to vary the details of the scheme, and that it ought to be made an instruction to the Commissioners, before framing the statutes and regulations, to confer with duly accredited representatives of the Senate and of Convocation, as to the modifications which may be desirable."

Now whatever be the opinion of different sections of Convocation on the general merits of the question, I think that we are all agreed as to the latter part of the resolution. Convocation regards the Report as a possible basis for reconstruction, but declines to pledge itself to all the details. But it is most important to observe, and it was most clearly pointed out in the debate, that in adopting this resolution Convocation *waived its right of veto*. In other words it dropped its possible *non possumus* and looked to negotiation to attain what it wanted.

This resolution was followed by a further one, which was its necessary executive corollary. I may be permitted to extract the whole from the minutes, as it is significant to observe that it was moved and seconded by a representative of either side.

"On the motion of S. P. Thompson, D.Sc., B.A., seconded by T. B. Napier, LL.D. Resolved:—

"(1) That a Special Committee of nine members, including the Chairman of Convocation, be nominated to prepare for presentation to the Statutory Commission, when appointed, a memorandum of points in the Scheme of the Royal Commission in which modification is desirable, and with power to confer with such said Statutory Commission, and with any Committee of the Senate.

"(2) That this Special Committee consist of the following Members:—The Chairman of Convocation, Dr. Allchin, Mr. Bompas, Mr. Stanley Boyd, Dr. Cave, Mr. Cozens-Hardy, Mr. Thiselton-Dyer, Dr. Napier, Dr. S. P. Thompson."

Now I put it to Sir John, who, though I am glad to say not "an old," is certainly an experienced "parliamentary hand," whether the action he has taken is exactly courteous to Convocation in general or to its formally constituted Committee in particular.

What Sir John practically says to us is this: "You may do as you like, but I am taking the management of this business into my own hands." Now, we are undoubtedly proud of having a representative in Parliament; but I am very doubtful whether Convocation is prepared to accept that representative as its master.

The resolution of January 22, as it happened, owing to the prolongation of the debate, was not carried by a large majority. The question was therefore brought up again on May 14, and reaffirmed by more than two to one.

The present position then is this: Convocation has accepted the Report of the Commission in principle; awaits the appointment of the Statutory Commission; and has delegated to a Committee of men representative of various views the duty of conferring with it. This Committee, which has already held a preliminary meeting, can be in touch at any time with Convocation, and it is difficult to see what better machinery Convocation could provide to bring about the result which all reasonable men desire. And all this, Sir John, who is not a member of Convocation, and who has not apparently taken the trouble to acquaint himself with its proceedings, calmly sets aside for a new-fangled and unheard-of plan of his own.

(iii.) Sir John, in what I suppose I may call his defence, says "the University is the only body whose constitution it is proposed to change." I do not know, I am sure, how he arrives at this. But we, who have had to consider the point, have been advised very differently. It has been pointed out to us by very high legal authority, that some at least of the bodies which it is desirable to bring into closer co-operation with the University may be impeded by disabling enactments. And one of the strongest arguments brought before us in favour of a Statutory Commission was the fact that it is a legislative solvent, and could, subject of course to the approval of Parliament, remove any legislative impediment which stood in the way of its ordinances.

(iv.) What I have stated above is sufficient, I hope, to show that Sir John's interference really amounts to a grave invasion of the privileges of Convocation, and I am utterly at a loss to see by what considerations it can be justified. The principle of a *referendum* which it is proposed to force upon us, is one which can only be accepted after the most serious examination.

Let us consider what it involves. At present, on any question of moment, Convocation only proceeds to a decision after a prolonged debate. And I venture to say that in ability, and certainly in earnestness, the debates in Burlington Gardens will compare not unfavourably with those at Westminster. The divisions, it may be inferred, are the outcome of reasoned conviction. A *referendum* is a very different matter. It is only theoretically applicable when the issue is of the sharpest, and can be stated on the most explicit terms. For anything short of this it would be necessary to organise for and against any proposal a costly machinery in order to put before each voter a reasoned statement on one side or the other. But the Statutory Commission, from the nature of things, will have to deal with matters of the most delicate compromise, affecting, as I have shown, other institutions besides the University. To subject these to the accidents of a *referendum*, is, I venture to say, one of the maddest political expedients ever proposed.

I cannot refrain from adding one more remark. I deeply regret that Sir John, in addressing the President and other Fellows of the Royal Society, thought it worth while to point out to them that some of them were not his constituents. There are many students of practical politics who find it difficult to justify the existence of University Members at all. I take it that the only defence that can be made for them is that they are something more than the mandatories of merely local interests, such as may exist, say, in a borough. They stand in Parliament, if they have any claim to be there at all, as the representatives of those interests remote from party which ennoble and dignify the life of a nation. Universities may select and return such Members. But that duty performed, theirs begins. If Sir John really seriously thinks that it is inappropriate that a body of Fellows of the Royal Society should address the Member for the University of London on a matter of supreme public interest, then I can only say with the deepest regret that I hope that the day is not distant when our choice may fall on a man of larger sympathies with the interests of the higher education and learning.

W. T. THISELTON-DYER.

Kew, July 20.

P.S.—I think it important to add from the Bill a portion of Clause 3:—"(1) The Commissioners shall make statutes and ordinances for the University of London in general accordance with the scheme of the report hereinbefore referred to, but subject to any modifications which may appear to them expedient after considering any representations made to them by the Senate or Convocation of the University of London, or by any other body or persons affected." It will be seen (i.) that it practically accepts the procedure of Convocation and (ii.) gives a *locus standi* to other bodies beside the University which may be affected.—W. T. T. D.

SIR JOHN LUBBOCK seems to have a mistaken conception of the nature of the right of veto possessed by the Convocation of the University of London. The Charter of that University provides that Convocation shall have "the power of accepting any new or supplemental Charter for the University or consenting to the surrender of this our Charter." But such provisions cannot limit the action of Parliament. The provision is similar to the reference to Convocation at both Oxford and Cambridge of new statutes and of all alterations in old statutes proposed by the Council of the University. Our statutes take the place of the Charter of the University of London in many respects.

When Parliament has overhauled the Universities of Oxford and Cambridge by means of a Royal Commission, it has never occurred to any one that it would be proper to refer the statutes proposed by such Commission to the Convocation of Oxford or Cambridge. Sir John Lubbock's proposal to do what is parallel to this in the case of the University of London is a new departure. Whether he is aware of the customary procedure in dealing with universities, and thinks it objectionable, or whether he supposes that the plan he suggests is according to precedent, or, again, whether he is merely anxious to claim for his constituents an exceptional privilege by demanding which he will be giving effect to their wishes and justifying their selection of him as Parliamentary representative, does not appear.

For my own part, though not a graduate of the University of London, I have been most closely associated with its work and organisation—as professor in University College and as examiner in the University—during twenty years. My conviction is that there is a large body of graduates, members of Convocation, who do not at all approve of Sir John's too flattering claim on their behalf; they do not desire that the Convocation of London should be given exceptional powers possessed by no other body of University graduates in this or any country. They are deeply concerned for the progress and development of the University of London in its true character of the University in the greatest city in the greatest empire of the world. And they are prepared to forego the gratification of personal vanity offered by Sir John Lubbock, in order that an executive Commission may carry out without delay the important development of the University proposed by the Gresham Commission. These proposals have been already approved of by a majority of voters in meetings of Convocation at which they were considered and discussed; the plan of again submitting the matter to Convocation after a Statutory Commission has embodied the Gresham Commissioners' proposals in detailed enactments, is one which can have no other object than that of defeating or, at any rate, delaying the whole scheme.

Sir John Lubbock has adopted, and made himself the leader of this extraordinary and fantastic policy. It seems to me that he has by his action shown an unfavourable estimate of the intelligence of his constituents, and that the time may come when the Convocation of the University of London will require from its representative active co-operation in the task of organising the University, and single-minded devotion to the interests of science, learning, and education, together with attention to those interests in Parliament, in place of the empty flattery of an impossible proposal to confer on Convocation powers rendering the customary Parliamentary control of the University impossible.

E. RAY LANKESTER.

July 20.

WITHOUT entering into the vexed question of the Gresham scheme, will you allow me to explain, in a few words, the grounds on which so many of Sir John Lubbock's old friends and supporters join issue with him entirely on the attitude he has taken up in his letter to Dr. Foster.

We object to the proposed *referendum* to the graduates, and to the mode in which he suggests that it should be exercised.

First, as to the mode. If Sir John Lubbock insists on the maintenance of the right of veto according to the Charter, this should clearly be exercised in the only method provided by the

Charter, that is, by Convocation assembled in a regular way. The constituency may be, as Sir John states, an exceptionally educated and intelligent one; but a very large proportion of the graduates have never studied the question of reorganisation, and are ignorant of its complications and difficulties. We have already had painful experience of how the votes of these graduates may be influenced by inaccurate or misleading statements in circulars issued through the post on the eve of an election by the party who are hostile to the Gresham scheme. If made in debate in Convocation, these statements could at once be corrected.

But, secondly, we object to the *referendum* in itself. Convocation has already, twice, deliberately, knowing what it was about, waived the right of final veto by agreeing to the appointment of a *Statutory* Commission. It maintains its full right of presenting its views to this Commission, when appointed, and of protesting against any provision that may interfere with its rights and privileges; and, furthermore, of influencing Parliament against it through its Member, or through any graduate who may have a seat in the House of Commons, or through its Chancellor, who sits in the House of Lords, should any such provision still be retained when the Bill is presented to Parliament. Any further right than this Convocation does not claim.

For my own part, should the position assumed by Sir John Lubbock be maintained by Parliament, it seems to me that we must abandon all hope of bringing our University into a line with the requirements of the age. ALFRED W. BENNETT.

The Earliest Magnetic Meridians.

IN reply to Prof. L. A. Bauer's letter in NATURE of July 18, p. 269, I may remark that I possess two of Churchman's Magnetic Atlases. The first of these I now believe was published in 1790, and to be that described in his tract, "An Explanation of the Magnetic Atlas, Philadelphia, 1790." The lines on this chart are magnetic meridians only, as fully defined in Churchman's text, and largely based upon Cook's observations of the variation.

It is evident that Churchman depended largely on observation, as he discussed the question of the effects of a ship's iron in altering the value of the variation when observed on board ship.

The second atlas, which is dated July 1, 1800, has isogonic lines for each degree of variation with magnetic meridians superposed, similar to Yeates' Chart of 1819, which I also possess.

Lastly, I would observe, that Yeates mentions the charts of Halley, Bellin, and Mountaine, and Dodson in 1794, but makes no reference to Churchman, who presented a copy of his work to the Royal Society in January 1791. It is possible, therefore, that Yeates constructed his chart in ignorance of Churchman's work, but the latter certainly was the first of the two to construct magnetic meridians. ETTRICK W. CREAK.

London, July 20.

Variegation in Flowers and Fruits.

REFERRING to a letter by Mr. Newnham Browne, in NATURE of July 11, describing a parti-coloured rose, it may be of interest to state that a somewhat similar occurrence in the case of an apple is recorded by Mr. Darwin in his "Animals and Plants under Domestication" (vol. i. pp. 392-3). The reference is to a specimen which I brought from Canada, and of which I sent him a careful drawing. In this specimen it appeared as if a smooth-skinned bright green apple had been cut in half and joined to a rough brown *pomme-gris*. The line of junction was perfectly sharp, but not quite symmetrical, the brown portion extending over the whole of the bud, while the green just included the stalk. I was told that similar instances sometimes were found on the tree from which it was gathered.

J. D. LA TOUCHE.

Stokesay Vicarage, Craven Arms, July 12.

Science Scholarships at Cambridge.

THOUGH the arrangements for the competitions for Science Scholarships at Cambridge, as described in NATURE of July 18, are in many respects eminently satisfactory, yet from the point of view of the candidates they leave something to be desired.

In the first place, they are unduly favourable to those whose nineteenth birthdays will fall early in 1896, and correspondingly unfavourable to those who are six or eight months younger. They will compel these younger candidates not only to compete at a marked disadvantage in the matter of age, but also after a shorter period of reading in science; unless, indeed, they have sacrificed an important part of their general education by commencing specialised study at an undesirably early age. Secondly, they are calculated to throw out altogether any candidates who may, through illness or other causes, be unable to compete during the very limited period covered by the examinations as at present arranged.

Similar difficulties are avoided in the case of the Army examinations by holding them twice yearly, at intervals of about six months. In the present case, sufficient equality could be secured by a fairly strong group of colleges holding their examinations a little later—for example, in April or May.

If it be feared that only the inferior candidates would be left to compete at this later examination, we would point out that, on the contrary, there would be less chance of this happening if our suggestion be adopted than under the present scheme. In April or May the older of the previously unsuccessful candidates would be excluded, and only the younger and, presumably, better candidates would remain. On the other hand, the later examination would have attractions for the ablest of those still younger candidates, who will not, under the present system, come into the field until the autumn of 1896. W. A. SHENSTONE.

Clifton College, July 23. D. RINTOUL.

SIR JOHN LUBBOCK AND THE TEACHING UNIVERSITY FOR LONDON.

THE feelings of "surprise and regret" which we said had been aroused by Sir John Lubbock's election address, will not be diminished by the perusal of the reply to which, at his request, we gave publicity in our last issue. Rather the surprise will turn to amazement, that he should deem that to be a reply which evades every material issue, and appears to be written in ignorance or forgetfulness of all that has taken place. And the regret will be enhanced when it is observed that his language now makes plain what could only be inferred from his address, namely, that he has never grasped the distinction between a Charter granted by the prerogative of the Crown, and a scheme framed under the authority of the Legislature.

Yet Sir John Lubbock has for many years taken an active, and even a prominent, part in public affairs; has for many years occupied a seat in Parliament; has in the course of his lifetime seen almost every university in the three kingdoms reformed by the machinery of Statutory Commissions; and has, if we are not mistaken, himself sat on a Commission entrusted by the Legislature with the duty of remodelling the constitution of the great public schools, which, next to the universities, are the most important educational institutions of the country. That he should be unaware of the distinction, or have forgotten it, seems incredible; but his language and his reasoning seem to leave no doubt on the point. "I am glad," he says, "to observe that the only point objected to is the reference of any new *Charter* to Convocation. In this, however, I am not asking that any privilege which they do not at present possess should be conferred on my constituents, but only supporting what is now their legal right."

What then, we are forced to ask, is Sir John's idea of a Statutory Commission? Does it need an Act of Parliament to authorise a body of persons to formulate proposals affecting a public corporation or institution, which, when framed, may be accepted or rejected at the pleasure of those whom they affect? Or does he suppose that it needs an Act of Parliament to enable the Crown to concur with bodies which the Charter of the Crown has called into existence, in effecting a modification of the franchise which they enjoy? An Act of Parliament, we had thought, was an Act of the Sovereign Legislature, which changed the "legal rights" as they previously existed; and we had never heard that Parliament added to its necessary labours the superfluous

task of passing Statutes to enable people to do what they had already the "legal right" of doing.

If this is Sir John Lubbock's view of a Statutory Commission, it was not the view taken by the late Royal Commission, to whose Report he indeed refers, but whose Report, we are compelled to believe, he has never read. For, in words too clear for misunderstanding, they have expressly recommended that the proposed change should be effected, "*not by Charter*, but by legislative authority."[1] Is it possible to suppose that in the discussions which have taken place in the Senate on the subject of the Report, the distinction so clearly pointed out has never been noticed or commented on in that august assembly, though presided over by the highest legal authority in the realm? Or if (as we must needs assume) the distinction did not pass unnoticed, was Sir John slumbering in his chair; and when he concurred in voting the resolution, by which the Senate accepted generally the recommendations of the Commissioners, including this vital one, was he not aware of the meaning of his act? Every assumption we make seems incredible; yet it looks as if, notwithstanding, some or one of them must be true.

The authors of the protest addressed to Sir John Lubbock say truly that it would be "without precedent" to confer on Convocation the right to "supervise the Acts of a Commission entrusted with the reorganisation of the University of which Convocation itself is a part." But when we ask ourselves how this right is to be exercised, the matter becomes not only unprecedented, but almost inconceivable. Is the ratification or veto of Convocation to be exercised directly on the Acts of the Statutory Commission, so as to be interposed between such Acts and the "approval of Parliament in the usual way," and so as to exclude Parliament from the power of considering any proposals of its own Commissioners not so ratified? Or is it to stand in lieu of the ratification of Parliament, so as to transfer the power of Parliament to the individual graduates? Or is the ratification of Parliament to be given only subject to the power of the graduates to disallow the Act of the Legislature? Or is, perhaps, the ratification and veto to be exercised by the more compendious method of entrusting the Member for the University with a power to overrule the decision of Parliament and its Commissioners? We shall look with interest at the particular form given to the clause which Sir John Lubbock proposes to introduce into the Bill.

But yet, for one so careful of the "legal right," one or two strange things are to be observed as to his proposal. Convocation, as we all know, has already, like the Senate, accepted the recommendations of the Commission, and, like the Senate, claims to represent its views before the Statutory Commission, when appointed. Convocation has passed this resolution in the exercise of its "legal right," and in the legal mode, that is, in the mode prescribed by the Charter on which alone its rights depend.[2]

[1] "In view of the failure of previous attempts to settle this question, and of the difficulty and delay which must inevitably attend an alteration of the constitution of the University through the action of the University itself, we are of opinion that, in accordance with the precedents followed in other cases of University reform, the changes we recommend should be effected not by Charter but by legislative authority, and by the appointment of a Commission with statutory powers to settle, in the first instance, arrangements and regulations in general conformity with the recommendations which we are about to submit to your Majesty." (Report, p. xii.)

[2] The twenty-first clause of the Charter provides "That the Convocation of the University shall have the powers following (that is to say):—The power of nominating three persons for every Fellow to be appointed in the manner hereinbefore mentioned from a List nominated by the Convocation, as provided by this our Charter; with power to the Convocation, if it shall think fit, to enable absent members of the Convocation to vote on such nominations of Lists by Voting-papers, in such form or to such effect, and to be signed, transmitted, verified, and recorded in such manner, and subject to such regulations and provisions, as the Convocation may from time to time determine, *but not so to vote on any other matter*:—the power of discussing any matter whatsoever relating to the University, and of declaring the opinion of Convocation in any such matter;—the power of . . . accepting any new or supplemental Charter for the University, or consenting to the surrender of this our Charter or of any new Charter or supplemental Charter; provided, nevertheless, that the consent of the Senate shall be also requisite for the acceptance of any new or supplemental Charter, or the surrender of this our Charter or of any new Charter or supplemental Charter. . . ." (The italics are ours.)

Is it not a little strange, then, that this new power of ratification or veto, which is not an "existing legal right" at all, is to be exercised, not in the manner in which the acceptance of a new Charter is by the express language of the existing Charter to be exercised, but in a mode in which that very right, on the analogy of which the claim is based, cannot be exercised. But truly the argument is all of a piece; and the result is, that the individual graduate is to have a larger, and a more irresponsible, power in controlling the Acts of the Legislature, than he has in controlling the Acts of the Crown alone, acting on the instance of the Senate.

For, and this is the other strange thing, what in the view of this champion of "legal rights" is to become of the legal rights of the Senate? The Senate is the sole administrative governing body of the University. It is the Senate which must necessarily have the most intimate knowledge of the working of the system which it administers, and of the needs of the University for the conduct and reputation of which it is responsible. It is the Senate which would alone apply to the Crown for that new Charter which Convocation has the power of accepting or rejecting, and without whose application no such Charter would ever come under discussion. Surely it would be logical, or at least consistent in its illogicality, to require that the acts of the Statutory Commission should also be submitted to the approval of the Senate, and (let it be added) that the individual members of the Senate should record their opinion by means of voting papers. Or is it indeed only the "legal rights" of "constituents" that are to be, not indeed preserved, but extended by the creation of a new and exorbitant precedent?

POST-GRADUATE STUDY AND RESEARCH AT CAMBRIDGE.

THE Senate of the University of Cambridge have now approved new statutes for submission to Her Majesty in Council, conferring on the University the power of admitting to the degree of Bachelor of Arts, or Bachelor of Law, "advanced students" who have resided six terms, and have fulfilled certain requirements to be prescribed by ordinance from time to time.

The regulations which will become ordinances when the statutes are confirmed have been published, and run as follows. A few notes are added in square brackets by way of explanation.

REGULATIONS FOR COURSES OF ADVANCED STUDY AND RESEARCH.

(A) *Admission as Advanced Students of Persons who are not already Members of the University.*

(1) Applications for admission as advanced students shall be made to the Registrary.

No person shall be admitted as an advanced student who has not attained the age of twenty-one years.

(2) Each application shall be accompanied by

(i.) a diploma or other certificate of graduation at a University [British or foreign];

(ii.) a statement as to the course or courses of (*a*) advanced study or (*b*) research which the applicant desires to pursue, together with such evidence of qualification, attainments, and previous study as he may be able to submit;

(iii.) a certificate or declaration that the applicant has attained the age of twenty-one years.

(3) In exceptional cases persons who do not present a diploma or certificate of graduation [at another University] may be admitted as advanced students, provided they give such evidence of special qualification as may be approved by the Degree Committee of the Special Board of Studies with which the proposed course of advanced study or research is most nearly connected.

(4) Applications shall, in general, be submitted not later than the first day of October in the academic year in which the applicant proposes to begin his course. But the authorities

specified in Regulation 5 shall have power to consider applications submitted at other times.

(5) The Registrary shall forthwith communicate each application to the Chairman of the Special Board of Studies with which the proposed course of advanced study or research appears to be most nearly connected.

Applications for admission to courses of advanced study shall be considered and decided upon by the Chairman of the Special Board.

Applications for admission to courses of research, and exceptional applications under Regulation 3, shall be considered and decided upon by the Degree Committee of the Special Board.

(6) The application shall not be granted unless it shall appear

(i.) that the course or courses of advanced study or research can conveniently be pursued within the University; and

(ii.) that the applicant has produced adequate evidence that he is qualified to enter upon the proposed course or courses.

(7) When the application has been decided, the Chairman shall inform the Registrary of the decision; and the Registrary shall inform the applicant.

(8) Before a person is admitted as an advanced student, he shall become a member of a College or Hostel, or a non-collegiate student [for this admission he must present satisfactory testimonials of character and attainments]. He shall not be allowed to count any term before that in which he has matriculated [by signing the matriculation book of the University, and paying a fee of £5: there is no "matriculation examination"], unless he has satisfied the Council of the Senate that his matriculation had been deferred for grave and sufficient cause.

(B) *Courses of Advanced Study.*

(9) An advanced student, who has kept two terms by residence, may in his third term of residence or in any subsequent term become a candidate for any of such Tripos examinations or parts of Tripos examinations as shall have been opened to advanced students under the provisions hereinafter contained.

The name of every such candidate shall be sent to the Registrary by the Prælector of his College or Hostel, or by the Censor of non-collegiate students, as the case may be, at the same time and in the same manner as the names of other candidates; but a mark shall be added to his name showing that he is an advanced student.

(10) It shall be the duty of each Special Board of Studies from time to time to consider whether the Tripos examination or a part only of the Tripos examination with which that Board is connected shall be open to advanced students, and also what standard in the examination must be attained by an advanced student in order that his name may be included in the list mentioned in the next Regulation; and their recommendation after approval by the General Board of Studies shall be submitted for adoption by Grace of the Senate.

In cases where two or more Special Boards are connected with a Tripos examination, the duty prescribed by this Regulation shall be performed by such Boards in joint meeting assembled.

(11) The names of such advanced students as satisfy the Examiners that they have attained the required standard in the examination shall be placed in alphabetical order on a list, written or printed, signed by all the Examiners and distinct from the Tripos list, which shall be regarded as the authoritative list and shall be preserved in the Registry. The Chairman of the Examiners shall send both to the Vice-Chancellor and to the Registrary a printed copy certified by him to be a correct copy of the authoritative list.

(12) An advanced student who has satisfied the Examiners as prescribed in Regulation 11 shall be qualified to enter upon a course of research, provided that the subject of his research be approved by the Degree Committee of one of the Special Boards.

(13) An advanced student who has satisfied the Examiners as prescribed in Regulation 11 and has kept by residence at least six terms shall be entitled to proceed to the degree of B.A. and thereafter under the usual conditions to the degree of M.A. and to other degrees in the University [*i.e.* for example, M.D., Sc.D., or Litt.D.].

(14) An advanced student who has satisfied the Examiners in the Law Tripos as prescribed in Regulation 11 and has kept by residence at least six terms, shall also be entitled to proceed to the degree of LL.B. and thereafter under the usual conditions to the degree of LL.M. and to other degrees in the University [for example, LL.D.].

(C) *Courses of Research.*

(15) An advanced student who has been admitted to a course of research shall pursue that course under such direction and supervision and under such other conditions as may be prescribed by the Degree Committee.

(16) An advanced student, who has kept two terms by residence, may in his third term of residence, or in any subsequent term, submit to the Degree Committee, not later than the division of the term, a dissertation containing an account of and embodying the results of his research. The dissertation shall be referred to one or more persons appointed by the Committee, who shall have power to examine the student orally or otherwise upon the subject thereof, and shall report thereon to the Committee. Each of the persons so appointed shall receive a fee of two guineas from the University Chest.

The Committee shall have power to take into consideration together with the dissertation any memoir or work [previously or subsequently] published by the student which he may desire to submit to them.

(17) If the Degree Committee be of opinion that the work submitted by the student is of distinction as an original contribution to learning or as a record of original research, they shall draw up a statement to this effect, indicating therein the subject or subjects of the student's research.

(18) The statement drawn up by the Degree Committee shall be forwarded by the Chairman to the Registrary, who shall embody it in a Certificate of Research in a form approved by the General Board of Studies. No such Certificate shall be granted unless and until three terms have been kept by residence.

Each candidate before receiving his Certificate of Research shall deposit in the University library a copy of his dissertation in a form approved by the Degree Committee.

(19) A student who has obtained a Certificate of Research and has kept by residence at least six terms shall be entitled to proceed to the degree of B.A. and thereafter, under the usual conditions to the degree of M.A. and to other degrees in the University [see Regulation 13, above].

(D) *Admission to Courses of Research of Persons who are already Graduates of the University.*

(20) A graduate of the University who desires to be admitted as an advanced student with a view to obtaining the Certificate of Research described in Regulation 18, shall make application to the Chairman of the Special Board of Studies with which his proposed course of research appears to be most nearly connected; and the application shall be considered and decided upon by the Degree Committee of the Special Board.

(21) The Degree Committee shall not grant the application unless they are satisfied

(i.) that the course or courses of research can conveniently be pursued within the University; and

(ii.) that the applicant has produced adequate evidence that he is qualified to enter upon the proposed course or courses.

(22) If the application be granted, the student shall become entitled to a Certificate of Research upon satisfying the requirements of Regulations 15–18.

(E) *Table of Fees for Matriculation, Examinations, and Degrees.*

	£	s.	d.
MATRICULATION.			
Advanced student (at any time, whether fellow-commoner or not)	5	0	0
[Certain Colleges, *e.g.* St. John's, Trinity, and King's, have recently admitted senior students, generally graduates of other Universities, as "fellow-commoners." These dine with the fellows, and have certain special privileges. Fellow-commoners not admitted as "advanced students" pay to the University a matriculation fee of ten guineas.]			
EXAMINATIONS.			
Advanced Students:			
On admission to a Tripos examination or a part of a Tripos examination	3	0	0
On submitting a dissertation for the Certificate of Research, on each occasion [*i.e.* the fee has to be paid again if the candidate is unsuccessful the first time]	5	0	0
DEGREES.			
Advanced Students:			
B.A. or LL.B. at any congregation for degrees ...	7	0	0

[The fee for these degrees, except at "general admissions," is ten guineas for students not admitted as "advanced students."]

Advanced students shall pay to the University Chest the same capitation tax as other members of the University, and under the same conditions as to standing (Graces June 1, 1893, and February 14, 1895): provided that the quarterly payment to be made by an advanced student, who has obtained a certificate of research but has not been admitted to a degree, and who has ceased to reside in the University, shall from and after the end of the eighth quarter from the commencement of residence be four shillings and threepence.

[The "capitation tax" referred to is thus in general ten shillings a quarter during the two years of residence, and four shillings and threepence a quarter thereafter until the advanced student removes his name from the boards of his College.]

The outcome of these regulations is this, that a graduate of a British, American, or other University, who can show evidence of special qualifications for advanced study in literature, law, history, or other like subject, or for scientific research, may be admitted under exceptionally favourable conditions to the University of Cambridge, He will not be required to pass the "previous examination" in Greek, Latin, elementary mathematics, and other subjects of preliminary education. He may reside two years instead of the three required of ordinary undergraduates. He will probably be allowed special privileges in respect of the University library, the museums, and the laboratories. He may become a candidate in the parts of certain of the Triposes concerned with his particular subject, or he may engage from the outset in independent research. If he approves himself sufficiently in the Tripos examination, or achieves results in relation to his research which may fairly claim "distinction," he may proceed to the degree of B.A. without further examination. Thereafter he need not reside further, but after the ordinary period of probation, pass to the higher degree of M.A. This opens the way to the doctorate in science or in letters for those whose after-work is of sufficient merit. A point of importance is contained in the second clause of Regulation 16, which provides that work published elsewhere may be taken into account in deciding whether an advanced student is qualified for his certificate or degree.

The "Degree Committee" of a Special Board consists of the professors and other elected members of the Board, but not the examiners for Triposes, &c., who are appointed for a year at a time. The special Boards deal respectively with theology, law, medicine, classics, oriental studies, mediæval and modern languages, mathematics, physics and chemistry, biology and geology, history and archæology, moral science, and music. The Triposes are the mathematical, classical, moral sciences, natural sciences, mechanical sciences, theological, law, historical, oriental languages, and mediæval and modern languages. It has yet to be determined what parts of these shall be specially opened to advanced students, but as most of them are divided into two parts, it is likely that the second or more advanced and specialised parts will as a rule be made available. The University has made concessions as to the fees to be paid by advanced students, and there is no doubt that as the scheme comes into working order, the colleges will follow the lead of the University in this respect.

The scheme is one which should lead to important developments in the future. Graduates of other universities, unless they came from Oxford or Dublin, or were specially "affiliated," could share in the advantages which Cambridge has to offer, only on condition of becoming mere undergraduate students, and so beginning their academic course over again. Now, if they are sufficiently qualified by previous study and attainments, they are admissible on a higher and definitely recognised footing, and may at once enter on post-graduate work. It is to be hoped that, at least in English-speaking countries, the opportunities thus offered for higher study in Cambridge may soon be appreciated; and that a steadily increasing number of those who now from our colonies and the United States proceed to continental universities in pursuit of learning may find in one of the old English universities a more natural and a more interesting academic resort.

THE HEALTH OF LONDON.

THE immense strides which have been made in sanitary science, the well-nigh feverish eagerness with which all questions relating to health are pursued, causes the layman to turn with interest and, indeed, curiosity to any reliable record he can obtain of statistics relating to the public health.

"What," he asks, "is the actual practical result of all these efforts on the part of municipal authorities and other responsible public bodies on the health of our great cities?"

It is thus that statistics become invested with an interest even to the uninitiated, and there is no more striking tendency in the hygienic crusade which prevails than the sense of individual responsibility which it has succeeded in arousing in the conduct of sanitary matters, and the participation of the people themselves in measures of sanitary reform. Hence the compilation and issue by the London County Council of periodic reports on a variety of hygienic subjects; and the appearance of "County Council Orange Books" may now be regarded as a familiar feature in the administration of that democratic body.

One of the most recent of these is the annual report of the London County Council's Medical Officer of Health for the year 1893.

This weighty document bristles with figures, and embraces a variety of subjects, but to only a few of the more important of these can we briefly refer here.

Perhaps the most appropriate point to start from, is the consideration of some interesting data dealing with the *expectation of life*, actuarily calculated, enjoyed by Londoners from five years upwards in the period of 1881–90 and 1861–70 respectively.

These statistics go to show that the expectation of life of males at five years of age has improved from 47·49 years to 50·77; or, in other words, during the last period there has been a gain of 3·28 years. As regards females, we find the expectation of life has risen from 50·87 to 54·43, or a gain of 3·55 years. At subsequent ages there is also, in all cases, an improvement, though relatively less than at age five, showing that the greater part of the gain is in the periods of youth and early maturity.

If we compare these tables with those of a similar nature, which have been compiled for each sex in Manchester and Glasgow from 1881–90, we find that the expectation of life in London exceeds that enjoyed by the inhabitants of both these large cities.

Londoners may also congratulate themselves upon the fact that the death-rate in London was lower than that of the majority of the capitals of Europe and of New York; thus, we can contrast a death-rate of 21·3 per 1000, with 21·8 in Paris, 22·3 in Rome, 24·0 in Vienna, and 30·6 in St. Petersburg, and in New York 23·9 per 1000.

As compared with our five largest cities—Manchester, Liverpool, Birmingham, Leeds, and Sheffield—London again can boast of the lowest death-rate; whilst our infant mortality, compared with that of other English towns having more than 200,000 inhabitants, was also lower in every case with the single exception of Bristol.

If we look more closely into the particulars of the death-rate, we find that, as regards the principal zymotic

diseases, London shows an increased mortality over the average for the preceding ten years, the rate having risen from 2·10 to 2·28 per 1000; and although this zymotic death-rate compares favourably with that of the largest of our towns, yet as regards foreign capitals it is only exceeded in two cases, *i.e.* by that of Stockholm and Vienna.

This increase is largely due to the alarming rise which has taken place in deaths from diphtheria, a rise represented by a death-rate of 0·12 per 1000 in the years 1871–80, 0·26 in 1881–90, 0·31 in 1891, 0·44 in 1892, and, lastly, 0·74 in 1893. Such a diphtheria death-rate is markedly in excess of that of other large English towns having a population of more than 200,000, being, in fact, more than double that of any with the exception of West Ham (virtually a part of London); it was even ten times as great as the diphtheria death-rate of Nottingham, and six times as great as that of Liverpool.

Small-pox also appears to be on the increase, and influenza and pneumonia claimed a number of victims greatly in excess of the average of the preceding ten years; and there is, also, a substantial increase registered in the scarlet-fever death-rate.

But the most serious problem which we have to face is our diphtheria epidemic; various attempts have been made to ascertain to what it can be traced, but so far, it must be confessed, we are without any satisfactory clue as to its source. It has been attributed by some to alterations in the classification of diseases, more especially by transference to diphtheria of deaths which in former years were registered as croup, by others to increased facilities for the spread of infection afforded by increased school attendance, to sewer ventilators, &c.; but the fatal objection to all these explanations is that they are circumstances which are shared by all the other great cities and towns of the country, and yet London alone is pre-eminent in its death-rate from diphtheria.

There appears, however, to be a very decided tendency in England for diphtheria to increase in densely inhabited centres, whilst in the more sparsely populated districts there is a decrease, which has been especially emphasised of late years.

Curiously, this is not the experience of our neighbours in Germany. Dr. Hecker has quite recently conducted an elaborate inquiry into the diphtheria death-rate during the years 1883-93 in a number of German cities, and he states that it is a decreasing one.

The problem of diphtheria in London is as yet unsolved, neither is its solution likely to be accomplished through such isolated, individual investigations such as have hitherto prevailed. What is required is the appointment of a Commission, composed of men abreast of the time, acquainted with modern methods, and capable of pursuing experimentally, if necessary, the course of this scourge.

Fortunately, as regards cholera, our past experience has enabled us to cope satisfactorily with what was at one time our most dreaded foe, and although Europe has suffered severely, England has escaped since the outbreak of cholera in London in the year 1866.

The freedom of London from this, to a large extent, water-borne disease brings us to the consideration of another malady in the communicability of which water is also largely responsible, *i.e.* typhoid fever.

In this connection it is satisfactory to read the following: "A point well deserving of observation, is the diminishing London typhoid fever death-rate."

Although it cannot be assumed that it is entirely due to improvement in the water supply of London, yet the evidence of the connection between typhoid fever and impure water supplies, has been too firmly established not to permit of the London water companies obtaining some credit for this improved hygienic condition.

On this point, the evidence afforded by the city of Zürich is instructive, for it has been distinctly found that since the establishment of the new filtration works in 1886, and the consequent greatly improved bacterial quality of the water distributed, a very marked diminution has taken place in the number of cases of typhoid fever. This fact has been vouched for after most careful investigation of facts and statistics by the city authorities.

Again, we have only to recall the invariable increase in cases of typhoid fever in Paris, when in consequence of an insufficient supply of purer sources of water, recourse has to be had to that of polluted river Seine water. Now Dr. Percy Frankland, in his reports to the Local Government Board, showed, for the first time in this country, the bacterial purification which Thames water undergoes at the hands of the London water companies; and although in his recent report to the Royal Society on the vitality of the typhoid bacillus in various waters, he points out that, whilst unable to increase in numbers, it can yet remain alive for days and weeks in water, yet we may assume that the typhoid bacillus will submit, as all ordinary water microbes, to the purification processes which Thames water undergoes before delivery, processes which Dr. Percy Frankland has repeatedly shown, removes frequently as many as 99 per cent. of the bacteria present.

Under the heading of "Administration," we read that the Council's inspectors made numerous inspections of dairies and milk-shops, as well as cow-sheds; as a result of these investigations, no less than 133 cases of scarlet fever were discovered as occurring on milk-shop premises, 46 cases of diphtheria and membranous croup, 21 cases of typhoid fever, 10 cases of small-pox, 5 cases of erysipelas, and 2 cases of measles. These probably represent only a proportion of the actual number of cases which took place in such establishments. Knowing as we do that milk offers every facility for the growth and abundant multiplication of pathogenic germs, it may be easily conceived how much zymotic disease may have been disseminated broadcast from these centres of infection.

In the recent report issued by the Royal Commissioners on tuberculosis, we find the following significant paragraph: "In regard to milk, we are aware of the preference by English people for drinking cow's milk raw, a practice attended by danger on account of possible contamination by pathogenic organisms. The boiling of milk, even for a moment, would probably be sufficient to remove the very dangerous quality of tuberculous milk."

We quote these words in full, not only because of the official weight which attaches to them, but because it is of such great hygienic importance that these facts should be known and realised by the general public.

On the continent, the practice of drinking raw milk is fast becoming obsolete, and sterilised milk is an article of commerce, and successful so-called "milk sterilising associations" have been formed for its distribution.

We have seen that, as regards the zymotic-disease death-rate, London is less favourably situated than the majority of the capitals of Europe. May we not possibly find at least one cause of this, to us humiliating fact, in the insular prejudice which prevails in favour of raw milk?

In conclusion, valuable as statistics may be and undoubtedly are, it must be remembered that there is yet much which statistics cannot reveal, that a lower death-rate cannot express the whole result of hygienic enterprise and progress. To adequately measure the value of sanitary reform to the community at large, we must look as well to the numerous and important improvements which have resulted in the increased comfort and well-being of the individual, and it is in such directions that the London County Council has accomplished some of its most useful and meritorious work.

THE RECENT RACE OF AUTO-MOBILE CARRIAGES IN FRANCE.

LAST month a most interesting race of auto-mobile carriages took place in France. The course taken was from Versailles to Bordeaux, and then back to Paris. June 11 was fixed for the day of starting, and forty-six carriages were to have taken part in the race, but only twenty-eight arrived in time, twenty-two of these taking active part, and nine performing the journey within

FIG. 1.—No. 5. MM. Panhard and Levassor's carriage, worked by gazoline, and to seat two persons (2nd prize, 12,600 francs). Arrived June 13, at 12.57 a.m.

a hundred hours; eight of the latter were worked by petroleum or "gazoline," and one by steam.

The accompanying illustrations, which we are enabled to reproduce by the courtesy of the Editor of *La Nature*, are from photographs taken at the exhibition of the carriages on their return. No. 5 (Fig. 1) is the one which was the first to arrive back in Paris. It received the second prize, for it only seats two persons, and a regulation had been made, that no carriage seating less than four persons could receive the first. No. 16 (Fig. 2)

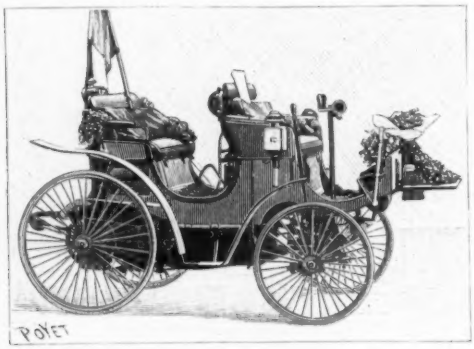


FIG. 2.—No. 16. MM. Peugeot's phaeton, worked by gazoline, and to seat four persons (1st prize, 31,500 francs). Arrived June 14, at 12.2 a.m.

really came in fourth, but received the first prize, for on reckoning up the time taken in the journey, it was found to be two minutes less than that taken by No. 8. The third prize was won by No. 15 (Fig. 3).

Taking all the facts into consideration, it appears that the lighter carriages travelled best. This proves the advantage of using petroleum or gazoline, for in order to produce one horse-power it requires per hour $1\frac{11}{144}$ lbs. of gazoline, whereas, if it were worked by steam, at least $6\frac{2}{3}$ lbs. of coal and $39\frac{1}{3}$ lbs. of water would be necessary per hour, and if worked by electricity, there would have to be accumulators of the weight of 220 lbs.

Light carriages have many advantages, for besides having to be less careful about the weight of fuel, they can also have lighter constructed wheels. M. Michelin's carriage, with pneumatic tyres, went the whole distance without an accident, whereas the steam vehicles, one and all, had mishaps, owing almost always to their great weight.

It would take up much time and space to relate the many incidents which occurred; suffice it to say that, apart from ordinary breakdowns, in some towns the travellers were hindered by the inhabitants, in others they were enthusiastically pelted with flowers.

These auto-mobile machines are evidently the carriages of the future. According to the *Times* of July 10, a journey has quite recently been performed in our own country by the Hon. Evelyn Ellis, who was accompanied by Mr. T. R. Simms, managing director of the Daimler Motor Syndicate. The carriage is a four-wheeled dog-cart, and will hold four persons, with room also for two portmanteaus. It was built by Messrs. Panhard and Levassor, of Paris, and is worked by petroleum, the cost

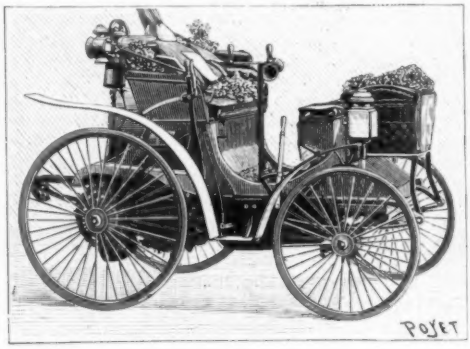


FIG. 3.—No. 15. Worked by gazoline, to seat two persons. Belonging to the sons of Peugeot Brothers (3rd prize, 6300 francs). Arrived June 13, at 6.37 p.m.

being about a halfpenny an hour. The journey undertaken by Mr. Ellis, a distance of fifty-six miles, was performed in five hours and a half.

We understand that the proprietors of the *Engineer* are offering a prize of £1000 to the maker of the fastest going motor. W.

NOTES.

WE regret to notice that Prof. C. C. Babington, F.R.S., Professor of Botany in the University of Cambridge, died on Monday morning, at the age of eighty-six.

PROF. RAMSAY has been elected a Correspondant of the Paris Academy of Sciences, in the Section of Chemistry, and M. Sabatier has been elected a Correspondant of the Section of Anatomy and Zoology.

MR. H. J. CHANEY, of the Standards Department, Board of Trade, will attend the Sexennial Conference of the International Committee on Weights and Measures at Paris, on September 6 next, as the representative of Her Majesty's Government.

DR. CARL BARUS, of the Smithsonian Institution, has, says *Science*, accepted the Hazard Professorship of Physics in Brown University. It is stated that Brown University has recently spent £20,000 in the building and equipment of a physica laboratory.

THE death is announced of Prof. Baillon, Director of the Botanical Laboratory of the Faculty of Medicine at the Sorbonne. Prof. Baillon was one of the most distinguished of French botanists, and perhaps quite the most prolific author of works in that science of the last quarter of a century. The *Times* gives the following details of his life. He was born at Calais, November 30, 1827, and was destined for the medical profession. He prosecuted his studies at Paris, and soon obtained prizes for work in "L'École Pratique," and in the hospitals. In 1855 he received the double degree of doctor of medicine and of the natural sciences. In 1864 he was appointed Professor of Medical Natural History to the Faculty of Paris, and soon afterwards Professor of Hygiene to the Central School of Arts and Manufactures. He was decorated with the Légion d'Honneur on August 17, 1867, and promoted to Officer July 13, 1888. His chief publication was "Histoire des Plantes," a vast undertaking, in twelve fully-illustrated volumes, the publication of which commenced in 1866, and concluded only three years ago. It has been partly translated into English. His next great work was a "Dictionnaire de Botanique," which he begun in 1876; the first volume appeared in 1878, and the fourth in 1885. He also published a number of monographs and studies on various natural orders and groups of plants.

MR. W. N. MOORE has succeeded Prof. Mark W. Harrington as Chief of the U.S. Weather Bureau.

MR. O. A. L. PIHL, whose careful measurements of the stars in the cluster χ Persei are well known in astronomical circles, has just died at Christiania.

PROF. J. G. AGARDH has presented his fine collection of dried algæ to the University of Lund, on the condition that it remains there intact, and the specimens not be lent out.

MR. CHARLES LEIGH, assistant in the General Library of the Natural History Museum, South Kensington, has been appointed to the post of assistant secretary and librarian to the Manchester Literary and Philosophical Society, created under the Wilde Endowment Fund.

A SHARP earthquake shock was felt at Algiers at 11.25 on the night of Friday last, July 19. The direction of motion is said to have been from west to east.

THE National Herbarium of the United States at Washington has been transferred from the building of the Department of Agriculture, and now forms a part of the National Museum in the Smithsonian Institution. The collection of grasses remains, however, with the Department of Agriculture, as also do the collections of the Divisions of Vegetable Pathology and Forestry. A movement is now on foot among American botanists for providing the National Herbarium with a suitable building and a staff of scientific assistants.

THE adjudicators appointed under the provisions of the deed of settlement of the Daniel Hanbury Memorial Fund have, says the *Pharmaceutical Journal*, awarded the eighth Hanbury Gold Medal to Dr. August Vogl, Professor of Pharmacology and Pharmacognosy in the University of Vienna. The medal is awarded biennially for the prosecution or promotion of original work in the chemistry and natural history of drugs. On the last occasion, in 1893, it was awarded to the late Johann Michael Maisch, who received it just before his death.

THE following grants have been made by the Council of the Chemical Society on the recommendation of the Research Fund Committee:—£30 to Messrs. J. J. Hummel and A. G. Perkin, for the investigation of certain natural colouring matters. £10 to Dr. H. Ingle, for the purchase of various aldehydes, ketones, and hydrazine, to continue his work on stereoisomeric osazones. £10 to Dr. J. J. Sudborough, to continue his work on diortho-substituted benzoic acids. £15 to Mr. E. Haworth, for the synthesis of an acid having the composition $C_8H_{14}(COOH)_2$, and the comparison of its properties with those of camphoric acid. £5 to Mr. R. E. Doran, for a research on the preparation of mustard oils by the reaction of chlorocarbonic esters with lead thiocyanate. £15 to Dr. W. A. Bone, to continue a research on the substituted succinic acids, and on the behaviour of various trimethylene compounds on treatment with the sodium compound of ethylic malonate. £10 to Dr. B. Lean, to extend his work on the derivatives of ethylic butane tetracarboxylate. £20 to Dr. J. Walker, for an investigation of the conditions of equilibrium between the cyanates and the corresponding ureas.

MR. W. SAVILLE-KENT, who has recently returned from Western Australia, has presented and otherwise placed at the disposal of the Trustees of the British Museum a further collection of Madreporarian corals and sponges collected by him on the north-western coast-line of the above-named colony. The series includes many new species and specimens calculated to prove attractive exhibits in the public galleries. With this latest addition included, the Natural History Museum becomes possessed of the most complete collection of Australian Madreporaria that has yet been brought together, and which now comprises typical examples collected by the same authority from every region of the extensive coral-producing waters of the Australian continent. Mr. Saville-Kent will probably be engaged for the next few months in the compilation of a book dealing generally with the more interesting natural history observations and investigations he has recorded and prosecuted during the past ten years while holding the appointments of Commissioner of Fisheries to the several Governments of Queensland, Tasmania, and Western Australia.

BY the provisions of the will of the late Dr. William Johnson Walker, two prizes are annually offered by the Boston Society of Natural History for the best memoirs written in the English language on subjects proposed by a Committee appointed by the Council. For the best memoir presented, a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the Committee. For the next best memoir, a prize not exceeding fifty dollars may be awarded. The competition for these prizes is not restricted, but is open to all. Attention is especially called to the following points:—(1) In all cases the memoirs are to be based on a considerable body of original and unpublished work, accompanied by a general review of the literature of the subject. (2) Anything in the memoir which shall furnish proof of the identity of the author shall be considered as debarring the essay from competition. (3) Each memoir must be accompanied by a sealed envelope enclosing the author's name and superscribed with a motto corresponding to one borne by the manuscript, and must be in the hands of the Secretary on or before April 1 of the year for which the prize is offered. The subjects for 1896 are:—(1) A study of an area of schistose or foliated rocks in the eastern United States; (2) a study of the development of river valleys in some considerable area of folded or faulted Appalachian structure in Pennsylvania, Virginia, or Tennessee; (3) an experimental study of the effects of close-fertilisation in the case of some plant of short cycle; (4) contributions to our knowledge of the general morphology or the general physiology of any animal, except man. The subjects for 1897 are:—(1) A study of glacial, fluviatile, or lacustrine phenomena associated with the closing stages of the glacial period; (2) original investigations in regard to the chalazal impregnation of any North American species of Angiosperms; (3) an experimental investigation in cytology; (4) a contribution to our knowledge of the morphology of the Bacteria.

REPORTS upon the circumstances attending an explosion which occurred in the Timsbury Colliery last February, prepared by Mr. J. Roskill and Mr. J. S. Martin, have just been published in a Blue Book. The explosion is interesting because fire-damp is practically unknown in the colliery. In this colliery, as throughout the Radstock series of the Somersetshire coalfield, naked lights are used; it is exempted from the application of the section of the Rule which prohibits explosives being taken down in mines except in cartridges, and gunpowder alone is used for blasting. It is evident from the inquiry that this exemption should be cancelled, and Mr. Roskill recommends that the use of gunpowder, except in cartridges, should be prohibited. Although before the explosion parts of the colliery were known to be dry, while more or less dust occurred in places, yet the mine was not regarded as a "dry and dusty mine." Judging from the explosion, however, the mine should come within that category. The explosion occurred at a spot which was apparently not dry and dusty within the meaning of the Act; but it was, if not caused, certainly intensified, by the presence of dust at much greater distances than twenty yards from the spot, though the Rule relating to shot-firing in a dry and dusty place, only prescribes watering within a radius of twenty yards. The moral drawn from the disaster is (1) that roburite, or one of the so-called flameless explosives, should, in future, be used instead of powder, and (2) that when places in a mine are admittedly dry and dusty, every place in the mine should be considered to be so, for the purpose of shot-firing, in order to make it imperative that, in such mines, the precautions prescribed by General Rule 12 should be observed in *all* places of firing.

WE have received a copy of the Report of the Epping Forest Committee presented to the Court of Common Council on June 13, of the present year, and containing the memorials which were reprinted in these columns a short time ago (June 13, p. 158). In presenting the Report the chairman, Mr. Deputy Halse, said that "if the action of your Committee were judged alone by the weight of authority attaching to those who have expressed themselves to be so entirely in accord with the past management of the Forest, a complete answer to the charges has already been made; but we prefer to await and present to your Honourable Court the Report of the eminent experts in Forestry whom we consulted last year, and by whose opinion and decision we are perfectly prepared to be judged and bound." We understand that the Committee of experts visited the Forest last week, and their judgment will be awaited with interest. Nothing could, however, strengthen the hands of the Committee more than the memorials which are now made public with their attached signatures. The value of the Report from a public point of view is greatly enhanced by a set of photographs reproduced from the illustrations in one of the daily papers, and placed opposite the views of the actual places which the newspaper artist is supposed to have represented. The article from the paper itself is reprinted *in extenso*, with a note stating that "the above article was accompanied by the illustrations reproduced on the annexed photographic sheet. Its accuracy may be judged from the photographs of those portions of the Forest so professed to be illustrated, which were taken within two days of the appearance of the article." The absurdity of the clamour, which is raised year after year by a small and irresponsible body of agitators, is well brought out by the article and its illustrations thus confronted with the true representations. Any paper that lends itself in future to such perversions will justly forfeit public confidence. The keen interest taken by the people in the management of Epping Forest is a very healthy sign, but the case against the present Conservators must indeed have been feeble if it was found necessary to resort to such pictorial artifices as are exposed in the Report issued by the Common Council.

UNSETTLED weather has prevailed in most parts of the British Islands during the last week, and thunderstorms have occurred in various places, while falls of rain exceeding an inch in twenty-four hours have been recorded on several days. In London, there were two distinct thunderstorms on Sunday last, one of which, between two and three p.m., was accompanied by an exceptionally heavy fall of hail. The amount of rain in London on that day was about 1·3 inch, which is the heaviest fall in twenty-four hours since last October.

AT the recent meeting of the Australasian Association for the Advancement of Science at Brisbane, Mr. C. L. Wragge proposed the erection of a meteorological station on Mount Wellington, Hobart. The proposal was supported by Mr. H. C. Russell, Government Astronomer of New South Wales, and by the Royal Society of Tasmania, in consequence of which the Government voted the necessary funds. An experimental station has just been established by Mr. Wragge on the summit of the mountain at a height of 4166 feet above sea-level, and a permanent observatory-house is now in course of erection. There are also corresponding stations at the Springs (2495 feet), and at Hobart (160 feet); we have no doubt, therefore, that results of importance will be derived from them. Mount Wellington is about four miles distant from Hobart, in a straight line, and rises almost directly from the level of the sea; it consequently offers considerable advantages for meteorological research.

THE Pilot Chart of the North Atlantic Ocean for July contains monthly charts, representing graphically the regions where fog was experienced most frequently on the North Atlantic during 1894. As this year can be taken as a typical one to illustrate the distribution at different seasons, it is interesting to note that during the first three months of the year fog is experienced on the Grand Banks and to the westward, but not in large quantities. During April it begins to extend to the northward and eastward, increasing in frequency as the spring advances, and reaching its maximum, generally, in June or July, during which months it may be expected anywhere between the American coast and this country in large areas and of long duration. In August the fog begins to dissipate in the eastern part of the ocean, and in September the decrease is very perceptible. During the remaining three months the charts show that it reaches its minimum again, and is mostly restricted to the westward of 40° west longitude.

SOME brief telegrams in the daily papers announced the occurrence of an earthquake in the Meshed district of Persia on January 17, but gave little indication of its destructive character. The centre of the earthquake appears to have been near Kúchán, a town which has been damaged or destroyed by earthquakes several times during the present century, the last occasion being in 1893, when it was completely reduced to ruins. After this the town was rebuilt on the old site, but the houses were made very largely of wood. At the beginning of this year, the new town contained about 2000 houses and 8000 inhabitants. On January 17, shortly before noon, another disastrous earthquake occurred. It lasted about a minute, and the shock was so severe that it completely destroyed every house in the town, with the exception of a few small shanties. The wooden pillars of the better-built houses were all broken in the middle. Numbers of people were buried in the ruins, but, owing to the lightness of the materials, the loss of life was much less than it would otherwise have been. The local authorities estimated the number of deaths from two to six thousand, but the careful inquiries of an attaché at the British Consulate-General at Meshed have reduced this figure to about

700. Orders have been issued by the Persian Government for the town to be rebuilt near Hai Hai, a place six or seven miles to the south-east, which experience has shown to be safe from destructive shocks.

THE history of the Russian Biological Station, on the island of Solowetzk in the North Sea, has already been given in our columns (NATURE, November 1894, p. 83). One of the most interesting of the results achieved by the naturalists of the laboratory has been the discovery of a remarkable lake on the island of Kildine in the Arctic Ocean. This lake, which is completely separated from the sea by a narrow strip of land, was discovered by the Russian naturalist, M. Herzenstein, who was struck by finding in the lake a fish which is exclusively marine in habit, namely the common cod. Further observations by MM. Faussek and Knipowitsch have elucidated the peculiar features of the fauna of the lake. On the surface the water is fresh, and is inhabited by fresh-water animals, such as Daphnids, &c.; this water is brought to the lake by streams from a neighbouring marsh. Under the superficial layer of fresh water is found salt water, supporting a Marine fauna—Sponges, Sea-anemones, Nemertines, Polychætes, marine Molluscs (*Chiton*, *Æolis*, *Astarte*), Starfish, and Pantopods. There is even a regular littoral zone beneath the fresh water, characterised by small *Fuci*. The bottom of this lake is covered with mud exhaling an odour of sulphuretted hydrogen, and is not inhabited. The water of the lake shows a slight ebb and flow, attaining a vertical height of only a few inches, while the tides in the adjacent sea are considerably greater. This fact would appear to point to the existence of some subterranean communication between the lake and the sea.

SOME important additions to a knowledge of the latest Mesozoic and early Tertiary mammalia have recently been made from Patagonia and the Uinta Basin. From the former place a collection of ungulates of very late Cretaceous date is described by Señor F. Ameghin in the *Bol. Inst. Geografico Argentino*, t. xv., 11 and 12. The most important is a new genus, *Pyrotherium*, which is made the type of a new sub-order, regarded as ancestral to the Proboscidea, and showing marsupial affinities. A number of other new genera are also described, and it is anticipated that when the fossil localities, which are very difficult of access, have been more fully investigated, still more valuable information on the late Mesozoic mammalia will be obtained. Large Dinosaurs and birds also occur in these beds.

PROF. H. F. OSBORN reports in the *Bull. Amer. Mus. Nat. Hist.*, New York, vol. vii., art. 2, on a more extensive collection than has hitherto been obtained from the Eocene beds of the Uinta Basin. Beneath the true Uinta fauna comes one which is intermediate between it and the Bridger and Washakie faunas, and thus supplies a most important link in the faunal succession of this province, while at the same time it shows affinities to the Miocene fauna of the White River. Among the mammalia found in this transitional fauna are a monkey, and species of *Telmatotherium*, which definitely confirm the view that that genus was ancestral to the Titanotheria. It is expected that still more valuable results may be got from a more thorough exploration that is being made this year.

THE application of electricity to locomotion has recently made notable progress in the United States. At a trial of electric motors at Nantasket Beach, near Boston, a few days ago, it is stated that a speed exceeding sixty miles an hour was attained; and the experiment demonstrated the utility of this motor for suburban traffic. The system went into practical and regular operation on the Nantasket Beach Railway at the end of June. A successful test has also been made at Baltimore of the electric ocomotive designed to draw trains through the tunnel, 7430 feet long, in that city. This and its companion—the first locomotives of the kind ever built—have each two trucks and eight wheels, sixty-two inches in diameter. Flexibly supported on each truck are two six-pole gearless motors, one for every axle. A maximum speed of fifty miles an hour is to be developed, and it is guaranteed that the locomotive will pull 1200 tons at a speed of thirty miles an hour. When coupled to a six-wheel New York Central locomotive, the electric locomotive pulled it up and down the track at will, against the pull of the steam locomotive.

AT a recent meeting of the Société Française de Physique, M. Pierre Weiss gave an account of the results of his experiments on the aelotropic magnetic properties of crystallised magnetite. The magnetisation curve of magnetite crystallised in the cubic system presents the same general features as those of iron, nickel and cobalt. The magnitude of the magnetisation (*i.e.* the permeability), however, varies with the inclination of the magnetising field to the crystallographic axes. Experiments have been made by a ballistic method suitably modified so as to permit of observations being made on very small specimens. The results thus obtained have been confirmed by other experiments in which a small disc of magnetite was rotated in a strong magnetic field, and the variations in the induction measured by means of a small coil surrounding the disc and connected to a ballistic galvanometer. The discs examined were cut parallel to the faces of the cube, octahedron and rhombic dodecahedron. If the results are expressed by drawing radii vectores from a given point of such length that they represent the magnetisation of the specimen in that direction when saturated, the surface which contains the ends of all these radii vectores is a cube with rounded edges, and with its faces slightly hollow. The magnetisation is the same in all directions contained in a plane parallel to one of the faces of the octahedron, so that the above-mentioned surface is cut by such a plane in a circular section. An experiment illustrating this aelotropic property of magnetite was shown before the Society. A small disc of magnetite placed on a plate of glass between the poles of a strong electro-magnet, turned so that one of its axes of maximum permeability was parallel to the field. Besides the difference which these experiments show between a body crystallised according to the cubic system and an isotropic body, they also show that the theories which regard magnetisation as resulting from the orientation of particles of fixed magnetic moment are insufficient to explain the magnetisation of crystalline bodies.

DURING his recent visit to the Algerian Sahara, M. Janssen made some decisive observations concerning the absorption bands near the D line of the solar spectrum, supposed to be due to atmospheric oxygen. The object was to test whether these absorption bands correspond to those observed on transmitting white light through a tube containing condensed oxygen. In some previous experiments on this question, M. Janssen had obtained these bands by means of a tube 60 m. long, containing oxygen compressed up to 6 atmospheres. An account of the Sahara observations is given in the *Comptes rendus*, together with a theoretical investigation concerning the equivalent height of the atmosphere. Starting with the remarkable law discovered by M. Janssen that the absorptive power of a gas is proportional to the thickness traversed and to the square of the density, the integration of the different layers of the atmosphere with their different densities gives 3981 m. as the equivalent thickness for a vertical ray of light. But since the density of oxygen is only 0·208 of that of the atmosphere, this number must be multiplied by 0·043, the square of that density. This gives 172 m. as the equivalent thickness of the oxygen layer. This thickness, at a pressure of one atmosphere, would not be ufficient

for showing the absorption bands, and this accounts for their absence when the sun is high in the heavens. But as the sun sets, the thickness of air traversed by its rays increases, and at an altitude of 4° the conditions are the same as those in the 60 m. tube at 6 atmospheres pressure. At this altitude they do in fact appear, and the excessive dryness of the desert air precludes the possibility of their being due to water vapour. Thus both the terrestrial origin of these oxygen bands, and also the validity of Janssen's law of absorption, have received a striking confirmation.

THE fifth volume of the *Geographical Journal*, comprising the numbers issued during the first six months of this year, has just been published.

WE have received the Report for the year 1894-95 of the Royal Garden, Calcutta, by the Curator, Dr. G. King, issued by the authority of the Government of Bengal. It reports a considerable amount of work done in the improvement of the Gardens, and especially in the increase and arrangement of the Herbarium.

THE number of periodicals, both in Europe and America, dealing with electrical matters is considerable, the last addition to the list being the *Electrical Journal*, a new monthly published in San Francisco. The first number contains a long account of the "Express" system of telephone switchboard. Other articles appearing deal with the efficiency of electric plants, the electrical installation on board the cruiser *Olympia*, and the field of operations of an electrical engineer.

THE volume containing the *Proceedings* of the American Association for the Advancement of Science at the forty-third meeting, held at Brooklyn last August, has lately been issued. As we gave at the time a report of the work of the Sections, and printed some of the presidential addresses in full, it is only necessary for us now to say that the volume is very well produced, and contains many very valuable papers.

THE fourth and apparently concluding volume of the *Seismological Journal of Japan* has recently been published. It consists of a very valuable paper of nearly 400 pages, by Prof. Milne, "A Catalogue of 8331 Earthquakes recorded in Japan between 1885 and 1892." The materials were obtained from 968 stations, distributed over the whole empire, the total number of documents being perhaps not less than eighty or a hundred thousand. In the first catalogue are given for each shock the time of its occurrence, the land-area shaken, and data by which the position of the epicenter and the boundary of the disturbed area are approximately determined. The second catalogue states the seismic district to which each shock belongs, the lengths of the axes of the disturbed area in tens of miles, from which the total area can be roughly ascertained, and, when the shock is submarine, the distance of the epicenter from the shore. The chief object of the paper is to provide trustworthy materials for future investigations, but some results have been already obtained and are briefly described. Prof. Omori's work on after-shocks has been referred to in a previous number (vol. li. p. 423). The distribution of earthquakes in Japan forms perhaps the most important section. Earthquakes, it appears, are singularly rare in the central parts of the country, which includes the mountainous districts where active volcanoes are numerous. The majority of shocks originates along the eastern coast of the empire, and many are of submarine origin. A large number seem to start from the face of the steep monoclinal slope which Japan presents towards the Pacific Ocean. Earthquakes are numerous where the slope is steep, and rare where it is comparatively gentle (see pp. 201-2). They are frequent in those districts where movements of secular elevation or depression are now taking place. Earthquake-sounds are often heard, but more so in the rocky mountainous districts than on alluvial plains. At the close of the paper is given a list of 301 seismic disturbances observed from 1889 to 1893 in Europe and at Teneriffe with the horizontal pendulum of Dr. von Rebeur-Paschwitz. Seven of these disturbances, and possibly five others, correspond to earthquakes in Japan.

THE flora of the Caucasus has lately been the subject of several interesting explorations and speculations by Russian botanists. The old data, contained in the works of Boissier and Ledebour, are now of little value, on account of the too broad remarks concerning the distribution of the different species, such as *Caucasus, provinciæ Caucasicæ*, and so on, which one finds in these otherwise classical works. On the other hand, such recent explorers as N. Kuznetsoff and A. Krasnoff, who have paid great attention to the composition of the floras of different parts of Caucasia, and their probable origin, have rather raised a series of most important geo-botanical questions than solved them definitively; while MM. Lipsky, Alboff, and Akinfieff have devoted their chief attention to the collection of positive systematic data, with exact indications relative to the distribution of different species. We have now in the "Memoirs (Trudy) of the Kharkoff Naturalists" (vol. xxvii.) a first instalment, by the last-named botanist, of a detailed list of plants in the middle parts of the Caucasus main ridge, with full indications concerning their vertical and horizontal distribution. Considering the generalisations of M. Kuznetsoff and M. Krasnoff as premature under our yet imperfect knowledge of the orography and geology of Caucasia, M. Akinfieff only ventures to formulate a few conclusions; namely, that the flora of Colchida is the youngest in Caucasia, as it has the least number of species, and especially of endemic forms, and that it contains but a small part of what constitutes the Mediterranean flora, as well as very little of what is found in other parts of Caucasia. The flora of Daghestan, Asiatic in its origin, has, on the contrary, in its steppe, sub-Alpine and Alpine representatives, a wide distribution over all Caucasia, with the exception of Colchida; four-fifths of the surface of Caucasia are thus genetically connected for their flora with Asia, and one-fifth only with Europe, the boundary between the two being, not the main ridge, but a broken line running approximately from Stavropol, or rather north of this town, along the water-parting between the Kuban and the Terek, to the Elborus, along the main ridge to the Adai-khokh, and further to the Mesques Mountains and the Suram Pass. It should be said that this conclusion seems to agree very well with what we now learn about the orgraphical structure of Caucasia, from which it appears more and more that the Mesques Mountains must be considered as a continuation of the border-ridge of the Asia Minor plateau, which ridge runs along the south-eastern coast of the Black Sea, and is continued north-east to meet the main ridge.

WE have received from Dr. Doberck, Government Astronomer of Hong Kong, the report of that observatory for 1894, containing *inter alia* an account of nineteen typhoons which occurred during the year, and the paths of which have been laid down on two plates. Information regarding storms is regularly exhibited and telegraphed whenever they can be justified by the observations received, but the work is apparently much interfered with by the tardy arrival of telegrams from the outlying stations. For the purpose of elucidating the behaviour of typhoons and other meteorological features, observations are regularly extracted from the logs of ships which visit the China seas, and tabulated for future use; in addition to these, observations are received from about forty land stations. The astronomical and magnetical work of the observatory has been regularly carried on, as in former years.

WHEREAS a few years ago the discovery of a new spirillum form was hailed as a bacteriological novelty, we are now constantly receiving fresh additions to this interesting group of microbes. With improved methods their detection and isolation have been rendered comparatively easy, and they are now found fairly widely distributed in water. Sanarelli isolated no less than thirty-two different vibrios from the river Seine, sewage-effluent, and pond water, and various authorities in Germany have detected such forms in rivers. So far the larger number have been obtained from river water, and have been but rarely met with in well water; but quite recently MM. A. Zawadzki and G. Brunner, of the Imperial Institute for Preventive Medicine in St. Petersburg, have discovered and isolated three vibrios from polluted well water, which do not liquefy gelatine, and in other respects are easily distinguishable from Koch's cholera vibrio. As regards their pathogenic properties, it is stated that white mice were quite unaffected when the vibrios were subcutaneously introduced. The investigations and descriptions have been carefully done and are fully recorded, and the authors are persuaded that they have discovered new forms. It is, however, difficult to decide this point, for only a slight acquaintance with the literature of the subject is apparent; and whilst the authors complain that Eisenberg's catalogue of bacteria is out of date, and those of Roux and Lustig are respectively incomplete, they do not appear to have any acquaintance with Percy Frankland's "Micro-organisms in Water," containing descriptions of over 200 bacteria found in water, neither have they consulted many important memoirs on vibrios which have been published in recent German and French journals.

THE writer of the note on p. 277, referring to hygrometric observations on the Sonnblick mountain, inadvertently wrote, "atmospheric electricity," instead of "atmospheric humidity," in the second line of the note.

THE additions to the Zoological Society's Gardens during the past week include a Mozambique Monkey (*Cercopithecus pygerythrus*) from East Africa, presented by Mrs. A. Canning Fysh; a Rhesus Monkey (*Macacus rhesus*) from India, presented by Mr. A. Kagele; an Irish Stoat (*Putorius hibernicus*) from Ireland, presented by the Viscount Powerscourt; a Suricate (*Suricate tetradactyla*) from South Africa, presented by Miss Dorothy Lowndes; a Bosch-bok (*Tragelaphus sylvaticus*) from South Africa, presented by Mr. W. Champion; six Orbicular Horned Lizards (*Phrynosoma orbiculare*) from Mexico, presented by Mr. E. J. Scarbrough; a West African Python (*Python sebæ*) from West Africa, presented by Mr. Edward Straw; a Red-sided Tit (*Parus varius*) from Japan, a White-browed Amazon (*Chrysotis albifrons*) from Honduras, two Adorned Terrapins (*Clemmys ornata*) from Central America, deposited; a Japanese Deer (*Cervus sika*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ALTITUDE AND AZIMUTH OF POLARIS.—It is a matter of common knowledge that the Pole star is about a degree and a quarter from the true pole, so that azimuths and latitudes cannot be directly determined by observations of this star. The usual mode of procedure is to employ tables reducing the observations to the true pole; a graphical method of performing this rather tedious reduction, with an accuracy sufficient for most purposes, has been devised by A. Tanakadate, of Tokio (Sūgakub.-Kizi.) It is shown that the usual formula for the calculation of azimuth corresponds very nearly with the equation of a circle of radius $p \sec \phi$ (p being the polar distance of Polaris, and ϕ the latitude of the place of observation), and the centre of which is displaced above the origin by an amount equal to $\frac{p^2 \tan \phi}{\cos \phi}$.

An origin being chosen near the middle of a sheet of squared paper, degrees and minutes are marked off along the axes in both directions, and a circle is drawn on the same scale with radius and displacement of centre adapted to the latitude as defined above. Radiating straight lines drawn from the origin correspond to different hour angles, the line $t=0$ being that along which the centre of the circle is displaced. The abscissa of the point where the line corresponding to the hour angle at which an observation is made cuts the circle, gives directly the azimuth of Polaris, the star being east or west of the true north according as the point lies to the right or left of the origin in the diagram. Neglecting errors of construction, the readings will only differ by a few seconds from the calculated results, and it is shown that even these errors can be reduced by slightly enlarging the radius of the circle.

If a circle be drawn from the origin as centre, with radius equal p, the diagram can also be used for reducing the latitude from observations of the Pole star by giving a small correction to the hour angle, $\frac{1}{2} p \tan h \sin t$, where h is the observed altitude, and t the hour angle. The ordinate of this circle gives the correction to be applied to the observed altitude in order to obtain latitude.

It is pointed out in the paper that these principles may easily be embodied in an instrument, and, in fact, such a contrivance is now in use among the students of astronomy in the Imperial University.

OBSERVATIONS OF DOUBLE STARS.—The measurements of position angles and distances of double stars made at the Paris Observatory from July 1890 to the end of last year, are published by M. Bigourdan in a very concise form in the *Bulletin Astronomique* for July. The telescope employed was that of the western tower, having an object glass 0·305 m. diameter and a focal length of 5·25 m., the magnifying power usually being 478. Most of the observations were made in the twilight or in the early night, at which times the star images are at their best. The list of stars observed includes about 150 from the Dorpat catalogue, 76 from the Pulkowa catalogue, and nearly 30 others; in many cases there are long series of measures of the same pair. A filar micrometer was employed.

At the Berlin Observatory, Dr. V. Knorre has used a double image micrometer in the measurement of double stars, and some of the results are given in *Ast. Nach*, 3300. The measures appear to agree very well with those of M. Bigourdan, in the case of stars common to the two sets of observations.

A GREAT NEBULA IN SCORPIO.—In the course of his work on the photography of the Milky Way, Prof. Barnard exposed a plate on the region near Antares for 2h. 20m. on March 25, 1895. The resulting negative showed a vast and magnificent nebula, intricate in form, and apparently connected with many of the bright stars of that region, including Antares and σ Scorpii. The nebula is gathered in cloud-like forms, the greatest masses being around ρ Ophiuchi and two neighbouring small stars. This photograph was taken with the Willard lens of 6 inches aperture, with which Prof. Barnard has previously obtained such splendid results.

Even more interesting is a photograph of the same region taken with a "lantern lens" of 1½ inches aperture and 5 inches equivalent focus, the exposure being 2h. 18m. The scale of this photograph is about 10° to the inch, and in addition to bringing out some new points about the great nebula, it shows the sky itself in that region to be very wonderful. The first photograph had shown that the nebula occupied a singularly blank part of the sky, from which large vacant channels diverged towards the east, and the negative taken with the lantern lens showed that these channels ran irregularly eastward for 15° or 20°.

The photograph taken with the lantern lens shows that the new nebula extends southward for two or three degrees beyond Antares and σ Scorpii in a southward direction. An elongated nebula about 2° or 3° long, involving the star ν^2 Scorpii, is also seen on the photograph.

Prof. Barnard goes on to say that "this magnificent nebula is one of the finest in the sky, and as it involves so many of the bright stars in that region it would imply that they are essentially at the same distance from us." (*Ast. Nach.* 3301). The unpretentious character of one of the instruments employed by Prof. Barnard is not the least remarkable feature about this new discovery.

NEW VARIABLE STARS.—*Wolsingham Observatory Circular*, No. 42, received from the Rev. T. E. Espin, announces that a red star of Secchi's Type III., magnitude 8·4, was detected at his Observatory on July 14, in R.A. 19h. 52·4m., Decl. 2° 11′ (1900). The star is probably a new variable, and is not in the southern *Durchmusterung*. The star designated Espin 1021 is also probably variable.

THE BRITISH MEDICAL ASSOCIATION.

AS already noted, the sixty-third annual meeting of the British Medical Association will be held in London next week. From the programme of final arrangements published in the current number of the *British Medical Journal*, it is evident that the meeting will be of exceptional interest and importance. The President-elect is Sir J. Russell Reynolds, Bart. An address in Medicine will be delivered by Sir William Broadbent, Bart.; an address in Surgery by Jonathan Hutchinson, F.R.S.; and an address in Physiology by Prof. Edward Albert Schäfer, F.R.S. The scientific business of the meeting will be conducted in fifteen sections:—Numerous papers have been received by each Section, and specific points have been selected for discussion. In the Section of Medicine, presided over by Dr. F. W. Pavy, F.R.S., the following subjects have been selected for discussion: (1) Diphtheria and its treatment by the antitoxin; acute lobar or croupous pneumonia, its etiology, pathology, and treatment; the causes of acute rheumatism and its relation to other affections. The President of the Surgery Section is Sir William MacCormac, who will make some introductory remarks, in which he will refer to the effects produced by modern rifle bullets on the human body. The following subjects have been selected for discussion: The diagnosis and treatment of fractures of the upper third of the femur, including the neck; the surgical treatment of cysts, tumours, and carcinoma of the thyroid gland and accessory thyroids. Sir William Priestley presides over the Section of Obstetrics and Gynæcology. The President of the Section of Public Medicine is Dr. Ernest Hart. The regular business of this Section will commence each day with a formal discussion by gentlemen who have been invited to open the debates. The subjects selected are as follows: Presidential address—Water-borne disease and its prevention; discussions upon the regulation of the slaughter of animals for human food and the inspection of animals before and during slaughter; the insecurity of tenure of extra-Metropolitan Medical Officers of Health under the Public Health Act, 1875. The Section of Psychology has for its President Dr. W. J. Mickle. The President will open the section with an address on the brain. A discussion has been arranged to take place on each day, the subjects being: On the treatment of melancholia; on insanity, in relation to criminal responsibility; on epilepsy, and its relation to insanity. The President of the Physiology Section is Dr. David Ferrier, F.R.S. In this Section a discussion on the mechanics of the cardiac cycle will be introduced by Prof. Haycraft and Dr. D. Paterson; the following will take part—Dr. Noel Paton, Dr. Lauder Brunton, F.R.S., and Dr. Gibson. The Anatomy and Histology Section has for its President Mr. Henry Morris. The following subjects have been selected for discussion: Art in its relation to anatomy; the development and structure of the placenta; the topographical anatomy of the abdomen. The President of the Section of Pathology and Bacteriology is Dr. Samuel Wilks, F.R.S. The work of the Section includes the demonstration of the malaria parasite by Dr. P. Manson, with some facts as to its life-history. There will be a discussion upon this, and upon neuritis; vaccinia and variola; pernicious anæmia; and lymphadenoma. The President of the Section of Ophthalmology is Mr. H. Power. The following discussions have been arranged in this Section: On certain rare cases of recurrent ophthalmia; on the diagnosis of orbital growths; on the question of operating in chronic glaucoma. The Section of Diseases of Children has for its President Mr. John H. Morgan; and the President of the Section of Otology is Sir W. Dalby. The Section of Pharmacology and Therapeutics has for its President Sir William Roberts, F.R.S. In this Section there will be a discussion upon serum-therapeutics, and upon the requirements of the profession with reference to the revision of the *British Pharmacopœia*. Dr. Felix Semon is the President of the Section of Laryngology; and Dr. H. Radcliffe Crocker, of the Dermatology Section. Finally, the ethics of the medical profession has a Section to itself, presided over by Dr. W. F. Cleveland. Only members of the British Medical Association, invited guests, and accredited strangers, will be allowed to attend the general meetings or the meetings of Sections. The reception-rooms will be opened on Monday, July 29, at 12 o'clock noon. The members' reception-room is in the large hall of King's College. A separate reception-room has been provided for invited foreign guests next to the members' reception-room, and another for ladies at the Royal Society's Rooms, Burlington House. The arrangements for the conduct of the work of the Sections, and for the comfort of the members, have been admirably arranged, so there is every promise that the meeting will be a very successful one.

HELIUM, A CONSTITUENT OF CERTAIN MINERALS.[1]

I.

THE gas obtained from the mineral clèveite, of which a preliminary account has been communicated to the Royal Society (*Proceedings*, May 2, 1895), has been the subject of our investigation since the middle of April. Although much still remains to be done, enough information has been gained to make us believe that an account of our experiments, so far as they have gone, will be received with interest.

We have attempted to ascertain, in the first place, from what minerals this gas, showing a yellow line almost, if not quite, identical in wave-length with the line D_3 of the chromospheric spectrum, and to which one of us has provisionally given the name "helium"—a name applied by Profs. Lockyer and Frankland some thirty years ago to a hypothetical solar element, characterised by the yellow line D_3 of wave-length 5875·982 (Rowland). We may state at once that it is not our purpose to attempt to prove this coincidence, but willingly to leave the subject to those who are more practised in such measurements.

We propose therefore, first, to discuss the terrestial sources of this gas; second, to describe experiments on products from several sources; and last, to propound some general views on the nature of this curious substance.

I. *The Sources of Helium.*

It is usual in a memoir of this kind to cite previous work on the subject. It would be foreign to our purpose to discuss observations on the solar spectrum; our memoir deals with terrestrial helium. And we have been able to find only one short note of a few lines on the subject; it is a statement by Signor Palmieri (*Rend. Acc. di Napoli*, xx. 233), that on examining a lava-like product ejected by Vesuvius, he found a soft substance which gave a yellow spectral line of wave-length 587·5; he promised further researches, but, so far as we know, he did not fulfil his promise. He does not give any details as to how he examined the mineral.

An account has already been given in Part I. of Dr. Hillebrand's investigations on the gases occluded by various uraninites which he was so unfortunate as to mistake for nitrogen. Dr. Hillebrand was so kind as to supply us with a fair quantity of the uraninite he employed; and it is satisfactory to be able to confirm his results so far; for it is beyond doubt that the gas evolved from his uraninite by heating it in a vacuum or by boiling with sulphuric acid contains about 10 per cent. of its volume of nitrogen. It is therefore not to be wondered at, that he formed the conclusion that the gas he had was nitrogen; for he obtained some evidence of the formation of nitrous fumes on passing sparks through a mixture of this gas with oxygen; he succeeded in obtaining a weighable amount of ammonium platinichloride from the product of sparking it with hydrogen in presence of hydrochloric acid; and, in addition, he observed a strong nitrogen spectrum in a sample of the gas transferred to a vacuum-tube. Had he operated with clèveite, as will be shown later, he would have in all probability discovered helium (*Bull. U.S. Geological Survey*, lxxviii. 43).

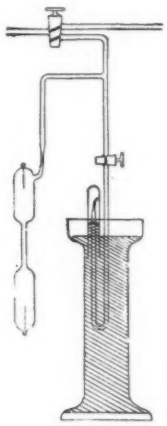
To extract the gas from small quantities of minerals, from 2 to 5 grams of the coarsely powdered substance was heated in a small bulb of combustion-tubing, previously exhausted by a Töppler's pump. As it was found that water and carbon dioxide were often evolved, a soda-lime tube and a tube filled with phosphoric anhydride were often interposed between the bulb

[1] A paper by Prof. William Ramsay, F.R.S., Dr. J. Norman Collie, and Mr. Morris Travers, read before the Chemical Society on June 20.

and the pump. After most of the gas had been evolved, the temperature was raised until the hard-glass bulb began to collapse.

Many of the minerals evolved hydrogen; hence, after the gas had entered the pump, the bulb was completely exhausted, and the gas was sparked with oxygen, no alkali being present. The oxygen was then absorbed with caustic soda and pyrogallic acid, and the gas was transferred to a vacuum-tube. As this process of transference proved very convenient, it is worth while to describe it in full.

The apparatus is shown in the annexed figure. It consists of a tube provided with a perfectly-fitting stop-cock; this tube is connected with a Töppler's pump. The vacuum-tube or tubes to be fitted are sealed to a lateral branch above the stop-cock. The lower part is bent into a sharp **U**, and the end drawn out to a point and sealed. The stop-cock is then turned full on, and the whole tube is completely exhausted, until the vacuum-tube shows brilliant phosphorescence, or, indeed, as often happens, ceases to conduct the discharge; the stop-cock is then closed. A mercury trough is placed below the bend of the tube, and the latter is sunk until the closed end disappears below the mercury. A small tube, which need not contain more than 1 c.c. of the gas to be introduced into the vacuum-tube, is then placed over the closed end of the bent tube, and the mercury trough is lowered. The sealed end is then broken by pressing it against the interior of the gas-tube, when gas enters up to the stop-cock. On carefully opening the stop-cock a trace of gas is passed into the vacuum-tube; this gas is then



pumped out and collected below the delivery tube of the Töppler's pump. One such washing with gas is usually sufficient. The stop-cock is again opened, and a sufficient amount of gas introduced into the vacuum-tube to show the spectrum. The vacuum-tube is then removed by sealing, and the gas still remaining in the bent tube may be transferred to the pump and collected. It is seen that this method permits of the filling of a vacuum-tube absolutely without loss, and it may be added with great expedition.

The results obtained with the minerals examined are given in the following table.

The spectrum of helium is characterised by five very brilliant lines; these occur in the red, the yellow, the blue-green, the blue, and the violet. In every case, except with hjelmite, fergusonite, and xenotime, in which cases the lines were merely seen, all these lines were identified by simultaneous comparison in the same spectroscope with the spectrum of helium from cleveite. With the gas from samarskite and in some other cases a still more careful comparison was made, and the absolute coincidence of every visible line was ascertained.

From many of these minerals, a hydrocarbon was extracted; this was manifested by the non-absorption of the gas by caustic potash until after explosion with oxygen. It would be interesting to ascertain whether the hydrocarbon is present as such in the mineral, or is formed during the heating, for in all cases where a hydrocarbon was evolved, a large quantity of hydrogen was also obtained. If a vacuum-tube be charged with the crude gas, merely deprived of carbon dioxide by caustic alkali, the spectrum consists almost wholly of the fluted bands of carbon.

Name of mineral.	Source.	Result.
Yttrotantalite ...	Rachwane, Ceylon	Hydrogen and helium.
Samarskite	Unknown	A little hydrogen and nitrogen. After sparking with oxygen over caustic soda, 15 grams yielded approximately 4 c.c. of helium. At high pressure (4 mm.) the unsparked gas shows fluted carbon spectrum. At low pressures this is invisible.
Hjelmite	Fahlun, Sweden...	No hydrogen; trace of helium.
Fergusonite ...	Ytterby, Sweden..	Do. do.
Tantalite	Fahlun, Sweden...	Trace of helium.
Pitchblende ...	Cornwall	50 grams yielded about 0·5 c.c. of helium. After fusion with hydrogen potassium sulphate a further very small quantity was obtained.
Pitchblende ...	Unknown	Small quantity of helium.
Polycrase	Hitterö, Norway..	Do. do.
	All these minerals contain uranium.	
Monazite	N. Carolina	Contains hydrogen and helium in fair quantity.
,, ...	Fahlun, Sweden...	Do. do.
,, ...	Bahia	Do. do.
,, ...	Skrotorp, near Moss, Norway...	Do. do.
Xenotime	Brazil	Hydrogen, and, after explosion with oxygen, a trace of helium.
Orangeite	Near Arendal.....	Easily gave a good spectrum of pure helium.
Columbite	N. America	Much hydrogen; no helium.
Perofskite	Magnet Cove, Arkansas	Very little gas; partly hydrogen.
Wazite.....	Sweden	Hardly any gas; trace of hydrogen.
Thorite	Norway	Fair quantity of hydrogen.
Fluocerite	Unknown	Carbon dioxide; glass etched.
Orthite	Hitterö, Norway..	Carbon dioxide and small quantity of hydrogen.
Gadolinite	,, ,,	Do. do.
Euxenite	,, ,,	90 grams gave 50 c.c. of gas, leaving 1·3 c.c. after explosion with oxygen. After sparking and absorbing oxygen, 0·1 c.c. remained. Not examined.
Cerite	Unknown	No gas.
Blende.....	Unknown	,,
Rutile	,,	No gas, except a trace of carbon dioxide.
Gummite.....	Flat Rock Mine, Mitchell Co., N. Carolina	Only oxygen.
Pyrolusite	Unknown	Trace of oxygen.
Native platinum	Brazil	Trace of oxygen in larger quantity, and trace of nitrogen.
,, ,,	Siberia	

It is here of interest to inquire which constituent of these minerals is effective in retaining helium. For this purpose, it is necessary to know their composition; but it has not been possible to make accurate analyses of all the samples of minerals treated. Hillebrand supposed that the gas was retained by the uranium, and states that its volume varies roughly with the amount of uranium oxides present. To decide the question, it is necessary to consider the composition of these minerals in some detail.

Yttrotantalite is essentially a tantalate of yttrium and calcium, containing a little tungstic acid, and small amounts of iron and uranium. The yield of helium was here small.

Samarskite is a niobate of uranium, iron, and yttria, containing smaller amounts of tungsten, zirconium, and thorium. The amount of uranium oxide is about 11 or 12 per cent.; of thorium oxide about 6, of yttrium 13, and of cerium 3. It yields a moderate amount of helium.

Hjelmite closely resembles tantalite in composition, but contains stannic oxide. The yield of helium was minute.

Fergusonite is a niobate of yttrium and cerium, containing only a small amount of uranium, zirconium, tin, tungsten, &c. The yield of helium was here minute.

Tantalite consists of tantalate of iron and manganese; the helium obtained was a mere trace.

Pitchblende consists mainly of the oxide, U_3O_8. The rare metals are present in English pitchblende in very minute amount. The helium obtained was very minute in quantity, and had a large amount of the mineral not been used it would doubtless have escaped detection.

Polycrase is a niobate of uranium, containing titanium, iron, yttrium, and cerium. The amount of helium obtained from it was small.

These minerals, it will be seen, all contain uranium. To them must be added clèveite and bröggerite, from which by far the best yield was obtained.

Monazite, which gave a good yield of helium, is a phosphate of cerium, lanthanum, and thorium, but does not contain uranium. It might serve, if necessary, as a source of helium, for it is comparatively cheap; it would form a more economical source than either clèveite or bröggerite.

Xenotime is a phosphate of yttrium, and yields a trace of helium.

Orangeite and *Thorite* are silicates of thorium containing small quantities of uranium and lead. The former of these yielded a fair amount of helium, but none could be obtained from a larger quantity of the latter.

From these details, it may be concluded that the helium is retained by minerals consisting of salts of uranium, yttrium, and thorium. Whether its presence is conditioned by the uranium, the yttrium, or the thorium, we are hardly yet in a position to decide. To judge by the Cornish ore, oxide of uranium alone is sufficient to retain it; but that its presence is not absolutely necessary is shown by its existence in monazite and xenotime. The high atomic weights of uranium and thorium, and the low atomic weight of helium suggest some connection; and yet yttrium, which possesses a medium atomic weight, sometimes appears to favour the presence of the gas; for yttrium is present in yttrotantalite, which, however, contains uranium, and in clèveite, in which uranium is present in relatively large amount.

None of the oxides of uranium, when heated in helium and allowed to cool, retains the gas; but similar experiments have not yet been made with oxides of thorium and yttrium, or with a mixture of these with uranium oxide.

(*To be continued.*)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

M. LIARD, Director of higher education in France, has been raised to the rank of Commander in the Legion of Honour.

BY the will of the late Mrs. Fraser, widow of the late Bishop of Manchester, a sum of £3000 is bequeathed to Oriel College, Oxford, for the foundation of a Scholarship.

MR. HENRY HILLS, who was an evening student in the Chemical Department of the Finsbury Technical College, has been elected by the Technical Instruction Committee of Accrington Town Council to the post of Principal and Head Master of the Accrington Municipal Technical Schools, just erected at a cost of £12,000.

AFTER ten years of quiet and unostentatious work in temporary buildings, the authorities of the Cambridge Training College for Women Teachers have been able to erect large and handsome college buildings by means of a grant from the Pfeiffer Bequest and voluntary subscriptions. The new buildings will be formally opened on Saturday, October 19, by the Marquess of Ripon, and other well-known persons interested in education have promised to take part in the proceedings. Practical demonstrations will be arranged to illustrate some of the latest developments of educational method, both in teaching and training, so as to make the occasion one of special interest to those who are taking a share in the development of secondary education in England. The experiment of training teachers under new conditions, and to some extent on new lines, under the shadow of an old University, is of special interest, and the opening ceremony will afford a unique opportunity to those interested in secondary education to learn something of the nature and results of this experiment.

HER MAJESTY'S Commissioners for the Exhibition of 1851 have made the following appointments to science research scholarships for the year 1895, on the recommendation of the authorities of the respective universities and colleges. The scholarships are of the value of £150 a year, and are tenable for two years (subject to a satisfactory report at the end of the first year) in any university at home or abroad, or in some other institution approved of by the Commissioners. The scholars are to devote themselves exclusively to study and research in some branch of science, the extension of which is important to the industries of the country: University of Edinburgh, John D. F. Gilchrist; University of Glasgow, Walter Stewart; University of St. Andrews, Henry C. Williamson; University College, Dundee, James Henderson; Mason College, Birmingham, Robert H. Pickard; University College, Bristol, Samuel R. Milner; University College, Liverpool, John T. Farmer; University College, London, Emily Aston; Owens College, Manchester, William H. Moorby; Durham College of Science, Newcastle-on-Tyne, Alexander L. Mellanby; University College, Nottingham, Martin E. Feilmann; Queen's College, Belfast, William Hanna; M'Gill University, Montreal, Robert O. King; Queen's University, Kingston, Canada, Thomas L. Walker; University of Sydney, John A. Watt; University of New Zealand, Ernest Rutherford.

SCIENTIFIC SERIALS.

American Meteorological Journal, June.—The principal articles are:—The Thermophone, by H. E. Warren and G. C. Whipple. This is an instrument for measuring temperature, particularly of distant or inaccessible places. It was devised by the authors for the purpose of obtaining the temperature of the water at the bottom of a pond, but is also suitable for obtaining the temperature of the soil at various depths. The apparatus resembles Siemen's resistance thermometer, advantage being taken of the fact that different metals have different electrical temperature coefficients. The instrument is not yet self-recording.—California electrical storms, by J. D. Parker. The object of the paper is to inquire into the causes of the infrequency of electrical storms in California. At San Diego, for instance, the Weather Bureau has only reported two electrical storms in the last sixteen years. Among the principal causes, the author mentions the humidity of the atmosphere, the absence of excessive heat during the rainy season (September to May), and the absence of cyclones during the dry season (May to September).

Wiedemann's Annalen der Physik und Chemie, No. 6.—Survey of the present position of energetics, by Georg Helm. The two directions in which the conversion of physics into a science of energy has been most successfully carried out are those of mechanics and of thermodynamics. Two views of energy are at present struggling for supremacy, that which regards energy as a mathematical abstraction, non-existent except in equations, and that which regards energy as a concrete reality, filling space, and migrating continuously from one place to another. One of the chief generalisations of the science of energetics is this: In order that something may happen it is

sufficient and necessary that uncompensated differences of intensity exist.—Influence of gases in solution upon the silver voltameter, by John E. Myers. (See p. 276).—The aureole and stratification in the electric arc, and in discharges in rarefied gases, by O. Lehmann. The appearance of the electric arc with horizontal carbons is that of two gas jets burning against each other, and flaring vertically upwards. This is due to the currents of hot air ascending between them, and is the same as if the carbons were joined by a white-hot wire. There is no fundamental difference between the arc and discharges in rarefied gases, as may be shown by taking very small terminals or very large discharge vessels for the latter. That the current travels not only through the arc proper, but also through the surrounding "aureole," may be proved by approaching a magnet, which bends the aureole aside.—Magnetism of asbestos, by L. Bleekrode. The grey variety of asbestos is highly magnetic. Strips of so-called asbestos paper 4 by 3 cm. are attracted at 1 cm. distance by an electromagnet capable of carrying 5 kgr., and fibres of pure asbestos attract small particles of the same substance. Asbestos should only be used with great care in sensitive magnetic instruments.

Bulletin de l'Académie Royale de Belgique, No. 4.—On the specific heat of peroxide of hydrogen, by W. Spring. The method of cooling was employed, and aqueous solutions of various strengths were experimented upon. A 74 per cent. solution gave the value 0·6893, which fell to 0·6739 at 71 per cent., 0·6276 at 60 per cent., and 0·6208 at 34 per cent. On further dilution to 31 per cent. the specific heat rose again to 0 8065. Peroxide of hydrogen thus behaves very much like a solution of alcohol. Chemical decomposition probably exerts a strong influence upon the values at high concentrations, and 0·6208 must be taken as a superior limit. Woestyn's law would give 0·6840. Hence it follows that the internal work of hydrogen peroxide must be less than that of water.—On metageometry and its three subdivisions, by P. Mansion. The author gives a sketch of a system of geometry of n dimensions, by which the three varieties, those due to Euclid, Riemann, and Lobatchevski, respectively, can be deduced from elementary considerations. The theorem that a straight line, two of whose points lie in a plane, lies in that plane altogether, applies to all the varieties. But Riemann's geometry is characterised by the proposition: If, in a plane, two straight lines which intersect in a point A also intersect in a second point B, all straight lines passing through A will also cut the line A B a second time. If the sum of the three angles of a single triangle is equal to two right angles, the same applies to all triangles, and the space will be Euclidean. In Riemann's curved space this sum is greater, and in Lobatchevski's curved space it is less than two right angles.—On the period of frost extending from January 27 to February 17, 1895, by A. Lancaster. This amount of frost is unprecedented since 1838, when the mean of the minima for the days between January 8 and 27 was − 13°·4 C. at Brussels. This year the mean was − 11° C. The isothermals of mean temperatures during this period for Belgium show maxima of frost on the frontier of Limburg and north of Hasselt, the least cold being along an isothermal of − 5° passing along the coast through Ostende.—On a silicate which probably constitutes a new mineral species, by G. Cesaro. This mineral, which accompanies hexagonite (a violet manganiferous tremolite), comes from St. Lawrence County, N.Y. It is colourless, or a delicate opaline-pink. Its hardness is 45. It crystallises in the orthorhombic system, and presents two cleavages along two planes of symmetry. Hitherto it has probably been taken for enstatite, but it is distinguished from this by the sign of its bisectrix, by the absence of well-defined prismatic cleavages, by its fusibility before the blowpipe, and by its angles. From anthophyllite it is distinguished by the absence of iron.—Lunar topographical measurements taken on photographs, compared with the records of Lohrman and Mädler, by W. Prinz. A table is given of twelve craters near the centre of the disc, with the values of their diameters from the maps and photographs. The greatest difference between the two cartographers appears in the case of Ptolemæus, whose crater is given 21,518 m. broader by Mädler than by Lohrmann, and the latter observer is confirmed by the photographs.

Bulletin de l'Académie Royale de Belgique, No. 5.—Chlorobromomatic anhydride, by Dr. A. J. J. Vandevelde. This is obtained by the action of bromine upon chlorofumaryl chloride. It is easily sublimed, even at ordinary temperatures, in a current of dry air, and can be purified in this manner. Its formula appears to be $CCl.CBr.(CO)_2O$. It fuses at 113° and boils at 203°. It has a very irritating but not disagreeable odour, and violently attacks the mucous membranes. It is soluble in alcohol, ether, chloroform, carbon bisulphide, and benzol, and easily crystallises in needles by concentration. When sublimed, it crystallises in plates. Water only dissolves it slowly, and an aqueous solution, when spontaneously evaporated, gives a very soluble deliquescent substance, which only crystallises when nearly dry.

Proceedings of the St. Petersburg Society of Naturalists, vol. i. No. 1–3.—The St. Petersburg Society of Naturalists has introduced this year a most welcome improvement in its publications. The *Proceedings* of the Society are now published separately, in advance of the *Memoirs*, and all the communications are summed up by the authors themselves in French or in German. We have already received three fascicules of the *Proceedings*, which contain a number of interesting communications: on the petrography of central Caucasus and on Vesuvian lavas, by M. Loewinson-Lessing; on the morphology and phylogenetic relations of the Myriapoda, by P. Schmidt, from which we learn that the *Pauropus Huxleyi* is possessed of a pair of tracheæ, of a very plain structure, which open under the mandibles; on the flora of the Zerafshan region in Turkestan, by W. Komaroff; on the embryology of the Diplopodes, by N. Cholodkovsky; on the lymph glands of the earthworms, by G. Schneider; on geological researches in the Altai, by Prof. Inostrantseff; on the formation of the egg in the *Dytiscus*, by K. Saint-Hilaire; and on the Pantopodes of the Arctic Ocean and the White Sea, being a review of the species described and collected both by the author and different previous explorers, with a description of one new species and two new varieties.

Memoirs (Trudy) of the St. Petersburg Society of Naturalists, vol. xxiv., Section of Botany.—Besides the *Proceedings*, this volume contains two important works:—The sub-genus *Eugentiana* of Tournefort's genus *Gentiana*, by N. Kuznetsov, being an elaborate work of 530 pages, with a plate and geographical maps, and containing the systematic description of this sub-genus, established by the author, its morphology, and the geographical distribution of its species.—The flora of Crimea, by W. Agéenko, part ii., first fascicule, containing the tribes from the Ranunculaceæ to the Capparideæ. In the first volume of this work the author gave a review of the literature of the subject, as well as a review of the collections of Crimean plants which he had at his disposal, and an excellent sketch of the flora of Crimea and its dependency from the local physical and geological features of the country. Now he gives the full list of the vascular plants of Crimea, which will be followed by a review of the geological changes undergone by Crimea and their influence upon the present composition of the flora.

Bollettino della Società Sismologica Italiana, vol. i., 1895, Nos. 1, 2.—Whether, and to what extent, an earthquake-wave can afford criteria for reasoning with regard to the nature of the formations traversed by it, by Prof. P. M. Garibaldi.—On conical or horizontal pendulums, by Prof. G. Grablovitz. In this paper is described a simple form of horizontal pendulum designed for timing, or calling attention to, the beginning of a disturbance. The mode of suspension resembles that adopted by Gerard and Milne, and from the mass at the free end of the horizontal rod there projects downwards a wire into a small cup of mercury. When the pendulum is disturbed, an electric circuit is closed, and a bell is rung, or the time determined by stopping a clock, &c.—The Lecco earthquake of March 5, 1894, by Dr. M. Baratta. This earthquake was a very slight one, and its interest lies in the discovery by its means of a new centre of disturbance in Lombardy, with which other slight shocks may also be connected. The relation between these earthquakes and the geological structure of the district is discussed.—Vesuvian notes (1892–93), by Prof. G. Mercalli.—Seismoscope for electrical registration, by Prof. G. Mugna.—Geodynamic levels for continuous registration, by Prof. G. Grablovitz. The author has had two water-levels constructed for the geodynamic observatory at Ischia. They are each 2½ metres long, and are arranged north-south and east-west. The movements of the ground are indicated by floats, whose displacements are magnified fifty times by levers carrying pens at their free ends. Copies of the record obtained from the Laibach earthquake of April 14 are given.—On the velocity of propagation and on the length of seismic waves, by Prof. F.

Omori. (See p. 275.)—Notes on the state of Etna, by Prof. A. Riccò.—Notes on Italian earthquakes (January, February, 1895), by Dr. M. Baratta. These are inserted as an appendix to each number, and form a catalogue of all earthquakes, tremors and pulsations recorded at the Italian geodynamic and meteorological observatories, &c. They are a continuation of the valuable *Supplementi* to the *Annali* of the Ufficio Centrale di Meteorologia e Geodinamica.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 20.—"A Dynamical Theory of the Electric and Luminiferous Medium. Part II.: Theory of Electrons." By Joseph Larmor, F.R.S.

In a previous paper on this subject,[1] it has been shown that by means of a rotationally elastic æther, which otherwise behaves as a perfect fluid, a concrete realisation of MacCullagh's optical theory can be obtained, and that the same medium affords a complete representation of electromotive phenomena in the theory of electricity. The ponderomotive electric forcives were, on the other hand, deduced from the principle of energy, as the work of the surplus energy in the field, the motions of the bodies in the field being thus supposed slow compared with radiation. It was seen that in order to obtain the correct sign for the electrodynamic forcives between current systems, we are precluded from taking a current to be simply a vortex ring in the fluid æther; but that this difficulty is removed by taking a current to be produced by the convection of electrons or elementary electric charges through the free æther, thus making the current effectively a vortex of a type whose strength can be altered by induction from neighbouring currents. An electron occurs naturally in the theory as a centre or nucleus of rotational strain, which can have a permanent existence in the rotationally elastic æther, in the same sense as a vortex ring can have a permanent existence in the ordinary perfect fluid of theoretical hydrodynamics.

In the present paper a further development of the theory of electrons is made. As a preliminary, the consequences as regards ponderomotive forces, of treating an element of current $\iota\delta s$ as a separate dynamical entity, which were indicated in the previous paper, are here more fully considered. It is maintained that a hypothesis of this kind would lead to an internal stress in a conductor carrying a current, in addition to the forcive of Ampère which acts on each element of the conductor at right angles to its length. Though this stress is self-equilibrating as regards the conductor as a whole, yet when the conductor is a liquid, such as mercury, it will involve a change of fluid pressure which ought to be of the same order of magnitude as the amperean forcive, and therefore capable of detection whenever the latter is easily observed. Experiments made by Profs. Fitz-Gerald and Lodge on this subject have yielded purely negative results, so that there is ground for the conclusion that the ordinary current-element $\iota\delta s$ cannot be legitimately employed in framing a dynamical theory.

This result is entirely confirmed when we work out the properties of the field of currents, considered as produced by the convection of electrons. It is shown that an intrinsic singularity in the æther, of the form of an electron e, moving with velocity $(\dot{x}, \dot{y}, \dot{z})$ relative to the quiescent mass of æther, is subject to a force e (P, Q, R), given by equations of the form

$$P = c\dot{z} - b\dot{y} - d\Psi/dt - d\Psi/dx ;$$

in which (a, b, c) is the velocity of flow of the æther where the electron is situated, and is equal to the curl of (F, G, H) in such way that the latter is Maxwell's vector potential given by the formulæ of the type

$$F = \int \frac{u}{r} d\tau + \int \left(B\frac{d}{dz} - C\frac{d}{dy} \right) \frac{1}{r} d\tau ;$$

and where Ψ is the electrostatic potential due to the electrons in the field, so that $\Psi = c^2 \Sigma e/r$, where c is the velocity of radiation. These equations are proved to hold good, not merely if the motions of the electrons are slow compared with radiation, as in the previous paper, but quite irrespective of how nearly they approach that limiting value; thus the phenomena of radiation itself are included in the analysis.

An element of volume of an unelectrified material medium contains as many positive electrons as negative. This force (P, Q, R) tends to produce electric separation in the element by moving them in opposite directions, leading to an electric current in the case of a conductor whose electrons are in part free, and to electric polarisation in the case of a dielectric whose electrons are paired into polar molecules. In the former case, the rate at which this force works on a current of electrons (u', v', w'), is $Pu' + Qv' + Rw'$; it therefore is identical with the electric force as ordinarily defined in the elementary theory of steady currents. In the case of a dielectric it represents the ordinary electric force producing polarisation. So long as a current is prevented from flowing, the ponderomotive force acting on the element of volume of the medium is the one of electrostatic origin due to such polarisation as the element may possess, for as the element is unelectrified it contains as many positive electrons as negative. But if a current is flowing, the first two terms of (P, Q, R), instead of cancelling for the positive and negative electrons, become additive, as change of sign of the electron is accompanied by change of sign of its velocity; so that there is an electrodynamic force on the element of volume,

$$(X, Y, Z) = (v'c - w'b,\ w'a - u'c,\ u'b - v'a),$$

where, however, (u', v', w') is the *true* current composed of moving electrons, not the total circuital current (u, v, w) of Maxwell, which includes the rotational displacement of the free æther in addition to the drift of the electrons.

The electric force (P, Q, R) as thus deduced agrees with the form obtained originally by Maxwell from the direct consideration of his concrete model of the electric field, with idle wheels to represent electrification. It has been pointed out by von Helmholtz and others, that the abstract dynamical analysis given in his *Treatise* does not really lead to these equations when all the terms are retained; this later analysis proceeds, in fact, by the use of current-elements, which form an imperfect representation, in that they give no account of the genesis of the current by electric separation in the element of volume of the conductor.

The ponderomotive force (X, Y, Z) is at right angles to the direction of the true current, and is precisely that of Ampère in the ordinary cases where the difference between the true current and the total current is inappreciable. It differs from Maxwell's result in involving true current instead of total current; that is, the forcive tends to move an element of a material body, but there is no such forcive tending to move an element of the free æther itself. In this respect it differs also from the hypothesis underlying von Helmholtz's recent treatment of the relations of moving matter to æther.

The theory is applied (1) to the determination of the electric and magnetic stresses in material media and of the mechanical pressure caused by radiation, (2) to optical propagation, including detailed theories of dispersion and metallic reflexion, including also the influence of motion of the material medium. It is shown that if electrons are accepted as the basis of material atoms, the latter topic is fully elucidated; also that the theory is not at a loss when explanations of the phenomena of inertia, gravitation and spectra are demanded.

June 20.—"An Inquiry into the Nature of the Vesicating Constituent of Croton Oil." By Wyndham R. Dunstan, F.R.S., and Miss L. E. Boole.

The vesicating constituent, or more strictly, the pustule-producing constituent of croton oil, has been the subject of investigation by numerous chemists and pharmacologists during the past forty years. According to the researches of Buchheim, and more recently of Kobert and Hirscheydt, the vesicating action is due to an acid closely allied to oleic acid, which has been given the name of crotonoleic acid. This substance is now prepared on a large scale in Germany for medical use, being extracted from croton oil by the method devised by Kobert and Hirscheydt. This consists in saponifying with barium hydroxide that part of croton oil which readily dissolves in strong alcohol. The resulting barium salts are washed with water, then dried, and repeatedly extracted with ether, which dissolves the barium salts of oleic and crotonoleic acids. These salts are separated by means of ether, which dissolves only the barium crotonoleate, and this, when decomposed with dilute sulphuric acid and extracted with ether, furnishes the crotonoleic acid as a viscid oil.

Since very little is known about this acid, even its composition being undetermined, the authors prepared it with the object of studying its properties and, if possible, of determining the constitution since no fatty acid of known constitution exhibits the property of vesicating. Starting with the crotonoleic acid

[1] Printed in abstract in NATURE, xlix. pp. 260, 280.

prepared as described above, the lead salt was obtained and submitted to a process of fractional precipitation by adding successive quantities of water to its solution in alcohol. By this means crotonoleic acid was proved to be a mixture composed for the most part of inactive oily acids, the lead salts of which are precipitated first, whilst the true vesicating constituent (or its lead salt) is principally contained in the last fractions, and represents but a small proportion of the original material. It was observed that the conversion of the crotonoleic acid into a lead salt did appreciably affect its vesicating power.

The supposed active constituent of croton oil, crotonoleic acid, having thus been shown to be a mixture, the authors proceeded to attempt to isolate the vesicating constituent from croton oil direct.

By saponifying that part of croton oil which is soluble in strong alcohol with a mixture of lead oxide and water, and repeatedly fractionating an alcoholic solution of the lead salts with water, the later fractions, which possessed the greatest vesicating power, ultimately furnished, when submitted to a series of fractionations, a resinous substance having extraordinary power as a vesicant. This substance could not be further resolved by repeating the process of fractional precipitation of the alcoholic solution with water. The same substance was isolated from the so-called "crotonoleic acid," and the authors propose to name it "croton-resin." To its presence the vesicating property of croton oil is due. The composition of croton-resin is expressed by the empirical formula $C_{13}H_{18}O_4$. So far all attempts to crystallise it, or to obtain crystalline derivatives from it, have been unsuccessful. It is a hard, pale yellow, brittle resin, nearly insoluble in water, light petroleum, and benzene, but readily dissolved by alcohol, ether, and chloroform. When heated it gradually softens, and is quite fluid at 90° C. Croton-resin has neither basic nor acidic properties; it may be boiled with a mixture of lead oxide and water without being appreciably affected. Ebullition with aqueous potash or soda gradually decomposes it, destroying its vesicating power. The products of this action are several acids, some of which are members of the acetic series. By oxidation of the resin with nitric acid a mixture of acids is obtained. The constitution of croton-resin is therefore complicated, and its molecular formula would appear to be at least $(C_{13}H_{18}O_4)_2$ or $C_{26}H_{36}O_8$. Since it is not saponified by a mixture of lead oxide and water, and as no glycerol could be detected among the products of its decomposition by alkalis, it is not a glyceride, and as it does not react with hydroxylamine or phenylhydrazine or sodium bisulphite, it is probably neither a ketone nor an aldehyde. The evidence so far obtained points to the conclusion that the constitution of the vesicating constituent of croton oil may be that of a lactone or anhydride of complicated structure.

"On the Magnetic Rotation of the Plane of Polarisation of Light in Liquids. Part I. Carbon Bisulphide and Water." By J. W. Rodger and W. Watson.

The aim of this investigation is the determination in absolute measure of the magnetic rotation of liquids at different temperatures, the effect of the chemical nature of the liquid on this property, and its correlation with other physical properties.

The present communication contains a description of the apparatus and method of experiment, and the results obtained with the standard liquids, carbon bisulphide and water, for sodium light, in a magnetic field of constant intensity, and at different temperatures between 0° and the ordinary boiling point.

In the case of carbon bisulphide three different samples were used, and identical results were obtained with three separate coils. In the following table are collected the mean values of the boiling point (b. p.), density at 0° (ρ_0), and Verdet's constant at 0° (γ_0). Verdet's constant may be defined as the rotation in minutes of arc produced in a column of liquid when the difference between the magnetic potentials at the ends of the column is equal to one C.G.S. unit.

		B. p.	ρ_0.	γ_0.
CS_2 No. 1	...	46°·25	1·29271	0·04348
CS_2 No. 2	...	46·26	1·29282	0·04347
CS_2 No. 3	...	46·26	1·29283	0·04347

It will be seen that the three different samples give practically identical values for the three physical constants.

The results obtained for the rotation of carbon bisulphide may be summed up in the following equation, where γ_t is the value of Verdet's constant at the temperature t,

$$\gamma_t = 0{\cdot}04347\ (1 - 0{\cdot}001696t).$$

The expression connecting rotation and temperature is therefore linear.

In the case of water the results are best represented by

$$\gamma_t = 0{\cdot}01311\ (1 - 0{\cdot}0_4 305t - 0{\cdot}0_5 305t^2).$$

Here the rate of change of the rotation with temperature increases as the temperature rises.

In the case of water the quotient γ/ρ, where ρ is the density is practically constant up to 20°, it then very slowly *increases*, the rate of increase between 20° and 100° being practically constant.

For carbon bisulphide the quotient γ/ρ *decreases* at a constant rate as the temperature rises, the rate of decrease being very much greater than the rate of increase in the case of water.

The measure of the molecular rotation which is usually employed in chemical investigations is

$$(M\gamma/\rho)_{\text{substance}} / (M\gamma/\rho)_{\text{water}},$$

where M is the molecular weight. Although the authors postpone a detailed discussion of the validity of this expression, they show that for carbon bisulphide, at any rate, its value changes with the temperature, and hence the conclusions obtained by its use regarding questions of chemical constitution, especially of tautomerism, are affected on this account.

They also point out that the above expression involves the properties of water. The only justification for the use of water in relative observations is the elimination of variations in the strength of the magnetic field in which the observations are made. If the temperature of observation is always the same, this can readily be done. If, on the other hand, the temperature varies, it is essential to know how the rotation of water alters with the temperature. In the past this alteration was unknown, and the arbitrary measure of the molecular rotation above referred to has come into use. Since an expression for the temperature variation has now been obtained it is to be hoped that observers will employ a measure of the molecular rotation which does not involve the properties of water. Indeed, other considerations make such a measure all the more desirable. Up till now the authors have made observations on eight liquids, besides water and carbon bisulphide, and in all cases except that of water the relation between rotation and temperature is linear, and the quotient, rotation divided by density, diminishes as the temperature rises. It is highly probable, therefore, that as regards magnetic rotation, as in the case of so many other properties, the behaviour of water is exceptional, and hence it is particularly ill-suited for the use to which it has been put. Again, on account of the smallness of the rotation in water, the unavoidable inaccuracies in determining its rotation, and thus estimating the strength of the magnetic field, produce a larger percentage error in the results than if a liquid, such as benzene, having a considerably higher rotation than water, were used for this purpose.

Chemical Society, June 20.—Mr. A. G. Vernon Harcourt, President, in the chair.—The following papers were read:—On the "isomaltose" of C. J. Lintner, by H. T. Brown and G. H. Morris. Lintner's isomaltose is shown to be merely impure maltose, and the isomaltosazone derived from it is maltosazone; maltose is the only substance produced in the diastatic conversion of starch which yields a crystallisable osazone.—Action of diastase on starch: nature of Lintner's isomaltose, by A. R. Ling and J. L. Baker.—The transformation of ammonium cyanate into urea, by J. Walker and F. J. Hambly. The velocity of interconversion of urea and ammonium thiocyanate under various conditions in aqueous solutions has been quantitatively studied; the numbers obtained can be interpreted by the dissociation hypothesis.—Note on the transformation of ammonium cyanate into urea, by H. J. H. Fenton.—Some derivatives of humulene, by A. C. Chapman. A number of derivatives of humulene, the sesquiterpene contained in the essential oil of hops, are described.—Note on thio-derivatives from sulphanilic acid, by Miss L. E. Walter. The parasulphonate-xanthate, $SO_3K.C_6H_4.S.CS.OEt$, obtained by the interaction of potassium xanthate and diazotised sulphanilic acid, is readily converted into derivatives of the sulphydride, $SO_2K.C_6H_4.SH$, a number of which are described together with their oxidation products.—Helium, a constituent of certain minerals (part ii.), by W. Ramsay, J. N. Collie, and M Travers. Fifteen out of about thirty minerals studied were found to yield helium, the density of the several samples of gas examined being about 2·2; the wave-length of sound in the gas corresponds to 1 : 1⅓, so that the atomic weight should be 4·4. Helium has the solubility 0·007 in water at 18°, and is hence the

least soluble gas known.—New formation of glycollic aldehyde, by H. J. H. Fenton. The acid, $C_4H_4O_6,2H_2O$, previously prepared by the author, yields glycollic aldehyde when heated with water; the aldehyde readily polymerises, yielding an amorphous hexose, $C_6H_{12}O_6$.—Ethereal salts of ethanetetracarboxylic acid, by J. Walker and J. R. Appleyard.—On the occurrence of argon in the gases enclosed in rock salt, by P. P. Bedson and S. Shaw. The nitrogen given off by the Middlesburgh brine contains about the same proportion of argon as does atmospheric nitrogen.—On the dissociation of gold chloride, by T. K. Rose.—On some physical properties of the chlorides of gold, by T. K. Rose.—The dissociation of liquid nitrogen peroxide (part ii.); the influence of the solvent, by J. T. Cundall. The dissociation of nitrogen peroxide in solution is dependent on the temperature and on the nature of the solvent; solutions in fourteen "inactive" solvents have been quantitatively examined.—Condensation of benzil with ethylic acetoacetate, by F. R. Japp and G. D. Lander.—On a method for preparing the formyl derivatives of the aromatic amines, by H. R. Hirst and J. B. Cohen. The primary aromatic amines yield formyl derivatives when treated with formamide in acetic acid solution.—A modification of Zincke's reaction, by H. R. Hirst and J. B. Cohen. The condensation of aromatic hydrocarbons with benzyl chloride, chloroform, &c., is readily brought about by amalgamated aluminium foil.—A method for preparing cyanuric acid, by W. H. Archdeacon and J. B. Cohen. Cyanuric acid and hydrogen chloride are obtained on heating urea and phosgene in toluene solution at 230° in sealed tubes.—The oximes of benzaldehyde and their derivatives, by C. M. Luxmore.—On a colouring matter from *Lomatia ilicifolia* and *Lomatia longifolia*, by E. H. Rennie. A yellow colouring matter, which seems to be hydroxylapachol, is found adhering to the seeds of the two species of Lomatia.—The colouring and other constituents contained in Chay root (part ii.), by A. G. Perkin and J. J. Hummel. In addition to the constituents previously isolated from Chay root, the authors now describe a hystazarin monomethyl ether and the three anthragallol dimethyl ethers.—The six dichlorotoluenes and their sulphonic acids, by W. P. Wynne and A. Greeves.—The disulphonic acids of toluene and of ortho- and para-chlorotoluene, by W. P. Wynne and J. Bruce.—Contributions to our knowledge of the aconite alkaloids. Part xii. The constitution of pseudaconitine; preliminary notice, by W. R. Dunstan and F. H. Carr.

PARIS.

Academy of Sciences, July 15.—M. Marey in the chair.—Researches on the electric discharge of the torpedo, by M. d'Arsonville. The author has investigated this discharge by means of self-registering apparatus, and has rendered it apparent by passing the current through various dispositions of a set of small incandescent lamps. At 19° C. the mean duration of a discharge is from 0·1 to 0·05 second. With torpedos from 25 to 35 cm. in diameter, kept for eight days in the laboratory basins, the E.M.F. oscillates between 8 and 17 volts, and the intensity between 1 and 7 amperes. There is no difference of potential between the two faces of the organ in repose. The two organs function synergically and with the same intensity, each organ having several sections giving independent discharges. During a discharge, the organ rises from 0·2° to 0·3° in temperature if short-circuited, but does not become heated if in open circuit. The electricity is produced in the organ itself, and not in the nerves serving it. M. Marey followed up this paper with a few appreciative remarks, emphasising the author's point that new light on the nature of muscular action might be expected from observations on the electric organs of the torpedo, and asserting that the author intends studying the effect of certain poisons and physical agents of which the action on muscles is already known.—On a bed of potassium and aluminium phosphates found in Algeria, and on the genesis of these minerals, by M. Ad. Carnot.—Calculation of fluid trajectories, by M. P. E. Touche.—A comparison between electric motors with continuous currents and those with alternating currents, by M. Duez.—On the absorption spectrum of liquid air, by Profs. Liveing and Dewar. Janssen's law that the intensity of the bands increases as the square of the density of oxygen would appear to indicate that these particular bands are due either to complex molecules produced by condensation, or to the encounters of molecules of ordinary mass, encounters which are more frequent as their free path is diminished. An examination of the absorption spectrum of liquid air and comparison with that of liquid oxygen under ordinary pressures shows that a thickness of 0·4 cm. of liquid oxygen gives a much greater band intensity than 1·9 cm. of liquid air. The bands in the liquid air spectrum become more intense as the nitrogen boils off. Mixtures of liquid air and oxygen confirm Janssen's law at low temperatures. Solid air, whether containing solid oxygen or not must remain doubtful, shows practically the same character and intensity of absorption as liquid air, hence the encounter theory is not borne out by experiment.—Action of the infra-red rays on silver sulphide, by M. H. Rigollot. Using silver sulphide as an electrochemical actinometer, its sensitiveness to infra-red rays has been recognised far beyond the last visible radiations. The E.M.F. produced may possibly be due to a calorific action.—On the detection and presence of laccase in plants, by M. G. Bertrand. Laccase has been recognised in many plants; a list is given. It appears only to be found in the rapidly developing parts, the older portions of plants not yielding this diastase-like substance.—On the essence of Linaloë, by MM. Ph. Barbier and L. Bouveault. This essence consists essentially of licareol with small quantities of a sesquiterpene, of licarhodol, and diatomic and tetratomic terpenes, together with 0·1 per cent. of a ketone, $C_8H_{14}O$.—On the penetration of embryos of "l'anguillule stercorale" into human blood and the relation between the presence of these embryos and certain fevers of hot countries, by M. P. Teissier.—On a transition form between cartilaginous and osseous tissues, by M. Joannes Chatin. The Gecko (*Platydactylus fascicularis*, Daud.) has furnished the tissue described.—On pelagic fishing in the deep sea, by MM. L. Boutan and E. P. Racovitza. The author is not able to confirm the existence of types specially adapted for life at great depths. He gives a list of forms found at from 400 to 500 metres below the surface, and shows that they are nearly the same as the forms asserted by Chun to be characteristic of great depths (1400 metres); the same types have even been collected near the surface. M. de Lacaze-Duthiers made some remarks on this paper, and particularly called attention to the suitability of the Banyuls station for this kind of work.—The phenomena of karyokinesis in the Uredinæ, by MM. G. Poirault and M. Raciborski.

CONTENTS.